November 1961

Agriculture

Vol. 68 No. 8

SELECTED CONTENTS

ublished for the Ministry of Agriculture, Fisheries
d Food by Her Majesty's Stationery Office

1s.
MONTHLY

Agriculture

Volume 68 Number 8 November 1961

EDITORIAL OFFICES
THE MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
WHITEHALL PLACE · LONDON S.W.1 · TRAFALGAR 7711

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What the reader wants

A journal that ignores the requirements of its readers does so at its peril. "Agriculture" is no exception, in spite of the fact that it has reached the ripe old age of 68; its editorial policies are subject to regular review, and last November we carried out a special survey amongst readers to see whether we were providing fully for their needs.

The response was excellent and we have gained valuable information about the sort of people who are now reading "Agriculture" and about their preferences.

Most of our readers by far are practical farmers and growers, and they are by no means confined to those who farm the bigger acreages. The Journal is also read widely by agricultural advisers, members of university and college staffs and students. More than half the replies received confirmed that present content and length of articles are what is required; but 26 per cent wanted articles to be more practical in their approach and 18 per cent asked for more scientific material.

We shall try to meet both these points of view; future articles will concentrate on the farmers' problems in the language of the practical man and will include references to any related scientific work of significance. We shall also continue to give prominence to the farm as a business. Interest in business techniques has grown rapidly in the last few years and many pages of "Agriculture" have been devoted to it. That this was a wise choice is manifest by the fact that 43 per cent of readers asked for more articles on farm business.

The shorter features, such as "In Brief", "Farming Cameo", "At the Farmers' Club" and the book reviews have a wide following and will be continued. But something must go if we are to expand in the directions indicated, so we have decided to drop the articles on agricultural shows and conferences, which can be handled more topically by the weekly farming press.

New ideas demand a new look. We hope, therefore, that readers will like the new cover and will find it more convenient to have the main contents listed on the front.

May we thank all those who participated in the survey for their help and assure them that we shall always welcome further ideas for improving "Agriculture".

The Editor

Revolution in Agriculture: 2

SIR WILLIAM SLATER, K.B.E.

Continuing the paper read by Sir William Slater at this year's meeting of the British Association

ANIMAL husbandry has received equally valuable help from the scientists in the post-war period. The methods of artificial insemination have been perfected so that the farmer can rely on this service and need no longer keep a bull. At first it was thought that the use of good bulls in the artificial insemination stations would result in an immediate marked increase in the average milk yield of our dairy herds. This assumption, at least for the milk-recorded herds, did not prove to be well founded. An examination of the records showed that the pool of genetic material was well spread and that differences between the high- and low-yielding herds were not primarily genetic in origin but arose from variations in the standards of feeding and management. There was, however, evidence that a few bulls were capable of siring daughters, whose milk yields over a wide range of management levels exceeded on average those of their dams. The selection of these bulls by progeny testing has been made possible by the use of artificial insemination, which permits of a large number of daughter-dam comparisons in many different herds. Improvements in the treatment of disease have increased the average effective life of the dairy cow and greatly reduced mortality in sheep flocks. Pig breeding, rearing and fattening has been put on a firmer scientific basis although, in this branch of agriculture, much improvement is still possible. In no section of farming has science had a greater influence than in poultry keeping. Here university trained geneticists and nutrition chemists are to be found on the staffs of the large hatcheries and broiler plants, and no one can hope to live in this world of intensive production and keen competition without a knowledge of the scientific principles on which it is based.

Fewer men, more machines

The available labour, however, fell. The prisoners of war had all left by 1949 and the Women's Land Army dispersed by 1951. Regular labour fell from 537,000 in 1946 to 455,000 in 1956. At the same time the wages of agricultural workers were rising steeply; to meet the shortage and higher cost of labour, the farmers turned to increased mechanization. By 1954 there were 450,000 tractors in use compared with 200,000 in 1946. The combine harvester, with its associated drying plant, was finding its way on to more and more farms. Machines were coming on to the market, designed to perform many of the tasks which had so far been done by hand. The cow barn was being replaced by the milking parlour and hand milking was rapidly becoming a thing of the past.

This rapid expansion in mechanization created its own problems. Farmers faced with high wages and shortage of men were being forced to spend capital they could often ill afford on machines. The problem for the smaller

farmer was particularly difficult; the use which he could make of a machine might be quite inadequate to justify the interest and depreciation on the capital outlay, yet if he was to farm efficiently, with the labour available, he needed the machine. For a time after the war this difficulty was partially overcome by the machinery pools run by the War Agricultural Committees. When these were discontinued the only solutions remaining to the small farmer, apart from buying a machine, were the employment of a contractor or co-operation with a neighbour. To the farmer, who frequently did not really appreciate the heavy depreciation charges he was incurring—the new, often complicated machines, unlike the simple pre-war implements, depreciated rapidly, even if they were unused—the contractor's charges seemed unduly high and co-operation with his neighbour unduly difficult; whichever alternative he took he was, to varying degrees, losing direct control of his farming operations. As a result many farms had an unjustifiable proportion of the available capital sunk in mechanical equipment, with a consequent heavy depreciation charge, which should have been, but was often not, provided for in cash reserves.

From 1946 onwards the new techniques introduced during the war, together with those which became available in the next decade, began to have a marked effect on production: yields of nearly all the main crops rose steeply. By 1956 cereal yields were exceeding those accepted as normal before 1946 by some 25 per cent. Potatoes were yielding, year by year, about 15 per cent more, although the effect of season makes this figure difficult to assess.

The production of grasslands was greatly increased and was utilized more efficiently by controlled grazing and silage-making. This was shown in the increased yields of the main products from grass: that of milk rose by over 40 per cent, beef and veal by nearly 60 per cent and mutton and lamb by just under 40 per cent. At the same time the output of pig meat rose by more than three times and that of eggs was almost doubled. The overall increase in production was such as to lift the net output of British agriculture to 156 per cent over the pre-war figure.

Greater production

This increased output, achieved with a diminishing labour force, was still rising without the stimulus of military or economic pressure.

The agricultural revolution had thus far followed the expected pattern; the forces which caused it were no longer operative but the techniques which they had evoked were carrying farming forward to higher standards of efficiency. The output from our farms has under this impetus continued to rise and will go on doing so unless fresh economic forces put a brake on production.

The present average yield of wheat is around 25 cwt to the acre, but many farmers expect to get an average over the years of not less than two tons. This is to some extent due to variations in soil and climate, but much of it is the result of differences in the standard of husbandry. The cost per ton on the farms with the higher yields is undoubtedly less than on those with the lower; so many of the costs have to be incurred whether the crop is good or bad. It is only when the cost of extra cultivations, additional fertilizers and of harvesting the heavier crop, exceed the return on the

increased yield, that the higher output per acre ceases to pay. Farmers who are getting the two-ton yields certainly believe that this is well within the profitable limit. They will strive for still higher yields and others will slowly copy them. With many farmers getting well above the average yield, there must be many others below. If these men adopt a higher standard of cropping the average yield of wheat throughout the country might easily rise to between 30 and 35 cwt per acre; a position would then be reached where either a limitation must be imposed on the acreage grown or the support price adjusted so as to prevent a rise in the total subsidy. The second of these alternatives would in the end also result in a reduced acreage as the less efficient producers were forced to cut their wheat acreage or ceased to grow it altogether. The home-grown production of wheat would then come from fewer acres, with a still higher average yield. Farmers who reduce their wheat land would seek fresh openings and try to enter other markets already suffering from over-production.

The same argument applies with equal force to milk production. This branch of farming has proved so efficient and profitable that output has risen beyond the demand for liquid milk, so that more must go to the lower priced manufacturing market. The result in the end must be either a restriction on output or a reduction in price. Here again, the less efficient farmer will be faced with the dilemma, should he go on producing milk at the lower, to him uneconomic, price or find some more profitable outlet for his activities.

Point of no return

British agriculture has reached a point of decision: it must either attempt to halt technical progress and rising output, relying on subsidies from the State for its future prosperity, or press forward ruthlessly, applying science to the full, and relying on the strength it so gains over the years, to face in the end fair competition from overseas producers, without the need for Government support.

If it takes the first way, then it will always be subject to changes in political policy, to the limitation of production and to pressure to direct its output to suit the changing pattern of international agreements. The efficient producers will prosper, so long as prices are still fixed high enough to enable the less efficient to survive. If, however, political pressure results in cuts in subsidies, the farmer using technical knowledge to the full will still be able to farm profitably, but his less progressive neighbour will no longer be able to do so.

The resulting pattern would be that which inevitably follows depression in agriculture—a period of attrition. Farmers who find their profits disappearing do not easily go out of business, they restrict expenditure on the farm to a minimum and cut their own standard of living. On such farms there is little possibility of further technical progress and the level of farming could well go back to that existing between the wars. Unlike the inter-war years, however, there are now many more technically efficient producers, who would continue to farm profitably. These men would almost certainly follow the example of the relatively few prosperous farmers of the 'thirties and take over the land of their less successful neighbours when they finally gave up the struggle. Thus by a painful process of decay, the pattern of

agriculture would be slowly altered, to one in which there were many more large farming units.

Should subsidies be continued but production restricted, then the efficient farmer will tend to suffer the more, because he depends on high production for low costs. Technical advances would be restricted to techniques which reduced costs without increasing output, an almost impossible condition. The result of any rationing of production must be a general depression in farming efficiency. Once the efficiency of farming can be seriously questioned, there will inevitably be an irresistible demand for the removal of subsidies. The result of the removal of support from an inefficient agriculture would be disastrous. Only the strongest would survive and farming as a whole would return to the condition of the inter-war years.

If, however, the farming community decides to take the bolder course and press forward with the application of scientific techniques, the way will be hard, but it will finally leave the farmers as free from political pressure as any other industry and equally free to demand the right to protection against unfair competition. Many large-scale progressive farmers could today stand up to fair competition from abroad without any Government support. For British agriculture to be on safe and solid ground the rest of the farming community must be brought up to this standard, whilst the pioneers go still further ahead. To achieve this, farming groups must be of a size which will permit the most effective use to be made of the available capital and allow economic mechanization. They must have at their head men who are able to understand and interpret in practice the findings of the laboratory; who understand modern methods of management; who can apply scientific methods to save labour; who can keep and use cost accounts in the organization of the business; and who have the time to think, read and direct.

No longer an art or a way of life

Farming in Britain is in far too many individual units for scientifically efficient production. Of all those employed in agriculture, approximately one-third are in charge of an independent business of great complexity. Whilst farming methods remained static from generation to generation, it was sufficient, even in a complex business, to apply traditional methods; a man having learned these methods could succeed by hard work and thrift. Modern farming techniques, however, are changing almost from day to day and the farmer is called upon to make decisions which, in relation to his business, are of such importance that in industry they would be dealt with at the highest managerial levels. Is it not asking the impossible to assume that one man in every three employed in agriculture should have the mental ability, educational background and experience expected of only the few who form the senior managerial staff in industry? Can we expect these men to make wise decisions on matters such as the amount of mechanization his farm can carry and the best form this should take, the optimum fertilizer dressings for his different fields and crops, the correct use of a complicated range of herbicides, and other agricultural chemicals, the planning of his buildings and farming operations to reduce labour to a minimum and perhaps, most important of all, the selection of suitable products which his land, the local climate and his fixed equipment will enable him to produce with the highest profit to himself?

It may be argued that he has the help of the National Agricultural Advisory Service, but with one District Officer to every thousand farmers, individual help can only be available to the few who have the mental equipment to realize the value of this help and ask for it. On the other hand, the farmer is the object of much high pressure salesmanship. There is no harm in this if he is capable of bringing sound and educated judgment to bear in relating what he is told to the complex needs of his own farm. What the salesman says about the value, for example, of a new machine may, so far as the machine is concerned, be correct, but the question is not what the machine will do, but whether, with the limited capital available, the machine is a good buy for the particular business. Decisions of this kind are too often made without the necessary careful calculation of the cost in interest, depreciation and maintenance, which are essential to a well-run business.

The farmer may also rely on the contractor for his spraying programme and for cultivations and harvesting. But the contractor must also live and his profit must be added to the basic cost of the operations and taken from the profit on the farm. It may be more profitable for a small farmer to employ a contractor, because either he has not the necessary specialized knowledge, or his farm cannot justify the interest and depreciation on the necessary machinery. Neither of these considerations would apply to a large farming group, where the specialist knowledge would be available and an amount of work sufficient to justify the machinery.

The maintenance of machinery also presents serious difficulties to the small farmer. Either he himself or his tractor driver has to carry out minor repairs, often with inadequate tools; major repairs have to go to an agricultural garage at relatively high cost and often with serious delays at important periods of farm work. As a result they often remain undone, with resulting serious damage to the machine. The large farming unit can afford its own fitter with a well-equipped shop and a regular schedule of repair and maintenance.

Farming is no longer an art or a way of life, but a highly scientific business and as such it calls for highly scientific management. This can only be achieved by the amalgamation of the many small units into larger holdings. Whether this is done by the voluntary joining together of smaller farmers or by the gradual absorption of farms by a large farming company is of secondary importance, provided the final result conforms to the same pattern. This pattern must ultimately be that of all successful industries in which a chief executive or group of executives is responsible for the running of the business with a highly trained technical staff. Such a system would place the control of farming in the hands of a relatively small number of the abler and better educated men engaged in agriculture. This would result in the wise and speedy application of new techniques, in rational decisions, based on factual records, as to the type and intensity of production and in the best use of the available capital. Whilst the able individual farmer might, by his intensive personal supervision, show a higher profit per acre or per man, the large farming units would undoubtedly show a better result over a large area than that obtained by a number of independent farmers of widely varying education and intelligence. Within the company there would be opportunity at the different levels for specialization in branches such as mechanization, stock management, or the use of fertilizers and agricultural

chemicals. The young man would no longer see the farming ladder as years of austerity and hard physical labour whilst he scraped together enough capital to begin to farm a small acreage himself, followed by even greater austerity and longer hours of work whilst he built up his holding to a reasonable economic size. He would see his advancement coming by promotion within the larger organization by the use of his brains and hard study and not by willingness to undertake long hours of dull routine toil.

Revolution of tomorrow

Such a reorganization of the industry would be painful and would involve many difficult sociological problems, but it would lead to a stable, healthy, independent and powerful British agriculture. It would involve specialization in production and the optimum output from every man. The arable acreage might well fall as the yield per acre rose, freeing land where milk and beef could be produced on good grass with the minimum of labour. The ultimate pattern would, as in other industries, shape itself to meet demand, once the rigidity imposed by the large number of individual units, each tied by management, capital equipment and tradition, to a largely inflexible system of mixed farming had been removed. Most important of all it would allow the technical revolution in agriculture to proceed to its logical conclusion, a new stable scientific agriculture.

The farm would have to be as much a place of industry as the factory and efficient production the first consideration on farmland as on the workshop floor. The concept of the country as a playground for the city would have to go, except in so far as land was set aside for this purpose.

The agricultural revolution has lifted farming from a state of depression and unimportance to one of prosperity and major position in the national economy. The farmers have now to choose whether they should take action to reorganize the industry so that it may take advantage of every technical advance and over the next decade so improve its efficiency that, no matter which way the political wind may blow, it is strong and secure; or whether they will rely on political bargaining to maintain the present position and avoid reorganization and further technical progress, with all that this implies in instability and the possibility of losing all they have won. Political memories are short and new generations are growing up who will forget the great debt the nation owed to the farmers in the war and think only of the immediate economic problems of the nation. When that day comes, the future of British farming will depend on how far the revolution brought about by the scientist and the engineer has been carried to completion.

Control of Potato Viruses by Insecticides

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Stocks of both early and maincrop potatoes can be kept for several years, given the right sprays at the right time and co-operation between growers.

MOST growers of ware potatoes in England and Wales buy new stocks of seed tubers every year or two, for they know from experience that their home-grown stocks often degenerate rapidly because of the two aphid-carried viruses, causing leaf roll and rugose or severe mosaic. Many of them would like to keep their stocks longer if they could do so with little trouble because, in most years, the price of new certified stocks is high and accounts for a major part of the cost of production; in addition, tubers that have been carried long distances may be damaged by handling or cold weather, and be subject to dry rot and other diseases. In the past there was also the danger of importing eelworms on the tubers, but that should be minimized if good seed is bought from reputable sources. Since 1948, experiments have been carried out at Rothamsted Experimental Station and elsewhere to find if the persistent insecticides developed during the last twenty years can prevent or limit virus spread by killing the aphid vectors.

Aphids transmit the two viruses differently. They are able to pick up and transmit the mosaic virus within minutes, i.e., during short feeds between flying from plant to plant, but they take longer to acquire the leaf roll virus, which needs one or two days within the aphid before it can be passed on. Having acquired virus, however, aphids with leaf roll may retain it for the rest of their lives, whereas those with mosaic will not remain infective for more than several hours at the most. The same aphid can carry both viruses, and a potato plant infected with both is very badly affected indeed. Mosaic is usually the more prevalent disease after warm, dry springs and early summers, when the weather encourages the aphids to fly frequently from plant to plant, whereas leaf roll usually predominates after cool, wet periods when the aphids are forced to remain longer on individual plants; however, leaf roll also spreads more in warm, dry summers than in cool, wet ones, because aphids are usually more numerous in fine weather. Such differences are important when considering insecticidal control programmes, for the time taken to kill aphids may greatly affect their ability to spread viruses.

Aphids overwinter in Britain on plants that are not susceptible to the common potato viruses, so they do not introduce virus when they first infest the crops in spring. All the experiments at Rothamsted were designed to test the control of spread of virus within the crop from plants infected at planting, the aphids picking up the viruses from such plants after they enter the crop. Later in the summer winged aphids leaving diseased plants in unsprayed crops may carry virus into the sprayed crops; such aphids can infect one or more plants before the insecticide kills them.

Testing different sprays

Initially experiments were done to compare several contact and systemic insecticides applied to the foliage every two weeks in high-volume sprays,

using overhead and underleaf lances. It was found that seven or eight applications of any good aphicide almost stopped the spread of leaf roll virus within the crop and decreased that of the mosaic virus by up to a half, depending on the weather and other factors that affect virus spread.

The next phase of the work was to find if fewer spray applications of different types were equally effective, and it was concluded that four applications of DDT emulsion, at the rate of 2 lb of active ingredient per acre per application, at either high volume (80 gal/acre) or low (25 gal/acre), were effective when applied with overhead and underleaf lances. Later tests showed that spraying contact insecticides from above only did not kill all the aphids, for most of them live on the undersides of the lower leaves.

Several important points became obvious during this work:

1. The experiments were successful only when little or no virus was introduced from outside the crop and incoming aphids not carrying virus were killed before they could acquire and transmit virus within the crop.

2. Earlier findings that much of the season's spread of virus within the crop was early, during May and June, were confirmed. The relatively few winged aphids colonizing the crop during that period are much more important as virus vectors than the many wingless and winged ones that usually develop on the plants later, because they probe many plants while depositing nymphs on them. Not only are the young plants more susceptible to virus infection than old ones, but aphids can acquire leaf roll much more readily from young infected plants; also winged aphids that develop on the crop later usually leave it rather than fly from plant to plant. It is thus essential to protect the plants with insecticide as soon as the shoots emerge and to keep them covered for the first two months of growth, after which they are much more resistant to infection. DDT, a cheap and safe insecticide, is very effective when first applied before the aphids arrive, but in the occasional year when infestation begins as the shoots emerge, application at 80 per cent emergence fails to kill all the aphids. It is advisable, therefore, to use a systemic insecticide such as demeton-methyl for the first spray at least, and now that four applications of such insecticides are allowed, they can be used instead of DDT.

3. In areas where virus is seldom introduced from outside it is worthwhile roguing the infected plants as soon as possible after disease symptoms show, to decrease the sources of virus within the crop.

Spraying and stock-saving

From 1954 onwards, a series of experiments with early potatoes was done at Efford Experimental Horticulture Station, Lymington, to supplement the work with maincrop varieties at Rothamsted and elsewhere. These were successful and the original stock of Ulster Prince was kept for eight years, when sprayed with DDT and rogued, before being discarded with nearly 10 per cent of virus-infected plants. In parallel experiments viruses spread rapidly in unsprayed crops, indicating that stocks kept for three years without spraying would be worthless. During the sixth and seventh years, when virus-infected plants totalled about 2 per cent and 8 per cent respectively, the home-produced stock yielded a saleable crop earlier than new certified stocks, and the seed cost very much less per acre than imported seed, despite the cost of spraying and roguing and the loss of profit from a

crop which could have been grown instead of seed potatoes. Although slightly more costly, it may be more satisfactory to grow a small acreage specially for seed tubers, rather than to save them from a ware crop, because it is easier to tend a small area carefully. With early potatoes, storage conditions greatly affect sprouting and earliness of yield, so subsidiary experiments on these are being done at Efford.

From 1952 onwards several trials with both early and maincrop varieties were done in different parts of England and Wales in co-operation with growers and N.A.A.S. officers. The main purpose of these was to find out how long stocks of potatoes could be kept reasonably healthy when they were sprayed with insecticides. Usually at least an acre was treated; some crops were rogued in addition, and a few growers were willing to leave "control" areas unsprayed. On some farms the remainder of the potato crops were sprayed once or twice during early July, often with the insecticide added to an anti-blight spray, to prevent aphids leaving the unrogued crops and taking virus elsewhere. If this practice were to become general it would greatly benefit potato growers, for the introduction of virus into healthy new stocks is the necessary preliminary to the rapid degeneration that occurs in many areas.

The difference between experimentation and commercial practice soon became obvious, for several of the trials had to be abandoned because the spraying was not begun early enough, could not be done at the correct intervals, or the insecticides were not applied properly. In a few trials so many plants became infected with virus introduced from other potato crops that the stock was not worth saving, and saving home-produced seed will not be practicable in certain areas unless growers co-operate with each other to prevent spread from crop to crop. Three such areas are the early-potato growing district of the Thames estuary and parts of the Cotswolds and Monmouthshire.

Success in retaining seed stocks

However, most of the trials showed that stocks could be retained for four or five years at least, including some seasons when viruses spread rapidly, in areas where it is customary to change the stocks annually or every other year. Although large aphid populations on potatoes occur most frequently in the East Midlands, degeneration was checked in several trials there. For example, (1) a stock of King Edward grown in the Wash area of Lincolnshire, and carefully sprayed and rogued, contained only 0·4 per cent of the plants with leaf roll and 0·1 per cent with rugose mosaic in 1959 after being grown for four years, and (2) a similar stock near Peterborough contained 3·3 per cent leaf roll and 1·7 per cent rugose mosaic after the same period.

These results show that the present practice of growing stocks for only one or two years has resulted in mainly healthy crops, with little spread of virus between them. If seed retention became widespread, as it was in the past, and inadequate precautions were taken to limit virus spread, particularly from one crop to another, the diseases might soon become prevalent again and the excellent work of the seed certification schemes would be undone, so all stocks kept for several years *must* be sprayed at least once during early July, even in their final year.

It seems that few growers are prepared to spray carefully enough at the requisite intervals, even if the weather permits, despite the considerable

monetary saving from home-produced seed in most years, so attention has turned to soil-applied or tuber-applied systemic insecticides, some of which have been developed recently. If these can be applied just before or at planting, and can prevent aphids from infesting the plants either throughout the season or at least during the crucial first two months of growth, without tainting the tubers or leaving poisonous residues in them, growers may prefer using such insecticides to spraying several times when they are otherwise busy.

The results of three years' preliminary work at Rothamsted and Efford have been most encouraging. Aphids on treated plants have been few or absent, and these insecticides, absorbed through the roots or skins of the tubers and carried up to the foliage, have given just as good control of virus spread as chemicals applied directly to the leaves. However, much more work needs to be done on the optimum amounts of insecticides to use, on the time taken for the plants to acquire effective doses of insecticides from the soil, on virus spread, and on toxic residues in the tubers, before growers can be recommended to adopt any particular practice.

It is hoped that many small-scale trials will be done during 1962 under the auspices of the commercial firms marketing the chemicals. In the meantime, those wishing to retain seed for a few years longer than has been customary, or seed-potato growers wishing to limit virus spread before they have rogued, are advised to spray the growing plants three or four times, either with one of the less toxic systemic insecticides or DDT, starting as soon as most of the plants have emerged.

Vegetable, Flower and Root Seed Trade in England

ROBERT K. W. KERSHAW

This article, written by a seed merchant, describes the development and present pattern of the trade in vegetable, flower and root seeds.

THE seed trade as a separate occupation started in the United Kingdom about the middle of the eighteenth century at the time of the Agricultural Revolution. Before that, vegetable growers and farmers seem to have saved seed from one year to another from the very poor plants that were then in cultivation, and some business in seeds seems to have been carried on by the herbalists and sellers of such medical concoctions as were available at that time. Some of the businesses started in the eighteenth century are still trading, one or two carried on by members of the same family after two hundred years.

With the Industrial Revolution and the coming of the railways in the 1830s and '40s, trade began to develop rapidly. Over the next thirty or forty years many new businesses were started and the trade developed on a national rather than purely local basis. At this stage the division between

wholesalers and retailers became marked. The latter group was, and still is, sub-divided into those selling to commercial users, namely farmers and market growers, and those supplying the general public in small quantities for use in gardens and allotments.

Growth of international trade

Improving communications resulted in an international trade springing up, and with it the introduction into this country of many plants native to other parts of the world. There was a corresponding outward flow of the cultivated varieties from the U.K. and Europe. This increased with the commercial development of the colonies and the United States, for many European seedsmen emigrated to start seed businesses overseas. Today the seed trade throughout the world has a high proportion of British names in its company titles. This trend has continued and up to the 1914 war resulted in a large export trade from the U.K. to the U.S. and what were by then the Dominions. The 1914-18 war disrupted this business, with the result that, in order to supply the needs of these countries, California in particular developed its seed growing and exporting regions. Californian produce not only replaced imports from Europe, but the U.K. in particular became a considerable importer of seeds from the new areas.

With the resumption of overseas business after the 1914 war, trading with Europe, particularly Holland, France and Italy, was re-established, and considerable acreages of seeds were grown in such countries as Hungary, Yugoslavia and Morocco, which have ideal climates for the production of seed of many species used in the U.K. At the same time New Zealand developed a considerable export trade to the U.K. in peas as well as herbage seeds. During the second world war, the pattern of trade was again completely disrupted. All European and Moroccan supplies were cut off, and in due course the United States, through the medium of lease-lend, supplied a large proportion of the essential requirements. Canada, which for some years had been supplying peas, in particular, increased her acreage along with that of New Zealand, and some items requiring the appropriate climatic conditions were produced in South America, South Africa, Australia, East Africa, and the Rhodesias.

Post-war conditions

During the lease-lend period imported supplies were handled by the Seeds Import Board, which continued to function for some years after the war. Other imports of vegetable seeds were subject to import licensing control, and for some years no importation of flower seeds was allowed. Gradually these restrictions were removed, and by 1950 private trade in vegetable seeds was getting back to normal. Shortly after this the importation of flower seeds was freed from licensing. These various upsets, "the great unwinding" as one leading seedsman called it, caused considerable financial strain on the trade, and in the early 1950s there were a few casualties as the pattern of trading was realigned to peace-time requirements. The trade settled down basically to the pattern as it is today, with some twenty or so wholesale houses and about a similar number of market grower seedsmen. Many of the latter carry on both sections of this business, and some overlap into the retail trade. These businesses contract for their own supplies with

seed-growing farmers in the U.K., or they import either direct from seed growers or from other contracting merchants overseas.

This pattern of trading applies generally to the majority of the items in the vegetable and flower seed trade, as carried on by the wholesale, market grower and larger retail houses supplying the U.K. market. Most root seeds are produced in the U.K., although limited quantities are imported, as for example, in the case of fodder beet. There is a considerable export market for English-grown root seeds and kale. Much of the retail trade in root and fodder seeds is, like the trade in herbage seed, in the hands of agricultural seed merchants, but generally speaking, the production of these is carried out, together with vegetable seeds, by the wholesale trade.

Pattern of seed production

As the first step in the production of vegetable, flower or root seeds, a U.K. merchant will usually place a contract on his own stock seed or on stock seed which has his prior approval, with either a British seed-growing farmer or with an overseas merchant acting as his agent who, in turn, will place it out with one of his local seed-growing farmers. At home, the merchant will supervise and rogue the crop and, after threshing, will take it into his warehouse for drying, cleaning, testing, etc. In the case of overseas production, the merchant with whom he has placed the contract will carry out these functions, but generally the English merchant will make visits to inspect the growing crops and see that the roguing and proper isolation have been carried out. The overseas merchant will supervise the harvesting and cleaning of the seed and in due course ship the produce to this country.

The U.K. merchants carrying on this type of business find it essential to maintain a considerable area of trial grounds on which they grow not only trials of every lot of seed received but also samples of varieties offered to them from time to time from home or overseas. They can thus keep a watchful eye on the work of their overseas merchants and producers and ensure that they are kept up to the job. Some indication of the detailed work required by a wholesale seed merchant may be gathered from the statistics of items offered. A typical wholesale catalogue will carry some 500-600 separate items of vegetable seeds and 1400-1500 items of flower seeds. The demand for each has to be separately assessed by the merchant as much as two years ahead of its selling period in the case of biennials, with the knowledge that bad weather and difficult harvesting conditions may upset all the calculations very seriously. The danger of the weather risk is such that many merchants split their contracts into widely separated production areas. This has the advantage of hedging the result, but the disadvantage of doubling a lot of the work. Customer preference varies so widely that even in one item the number of different varieties and colours carried may exceed 100. A particular case in point is illustrated by Stocks (Matthiola) which require 13 types, divided into 112 separate colours, exclusive of the mixtures, to satisfy the market-garden trade. The merchant will have to test for germination and purity every lot received and his carry-over. This work will give his seed testing station some 6,000 tests to carry out a year. Likewise the trial grounds will be required to make some 2,500 trials each year. The trials will not be as numerous as the tests since it is not necessary to put carry-over stock in trials.

Marketing to growers

The marketing of vegetable and flower seeds to commercial growers is done by a combination of direct mail offer (catalogue), and selling by travelling representatives. A seed house will have a number of travellers on the road, who call on the growers before the selling season and take orders for supply in the forthcoming season. About Christmas time a comprehensive catalogue will be dispatched to the growers, and during the period December to March the majority of the orders for growers' supplies will reach the merchant and be dispatched from his warehouse.

The greater part of the trade is on credit terms, most companies offering three months' credit, with a cash discount of 2½ per cent for one month's payment. A fairly large number of growers will take up to six months' credit, and to this extent the seed merchant becomes the banker for the grower. There is little difference in the system carried on by the wholesaler, who will deal with his retailers in like manner and on similar terms.

Root seeds reach the farmer through the medium of either the national seed houses, selling in the same manner as vegetable seeds are sold through representatives and catalogue offers, or alternatively through the country merchants, who carry seeds as a line additional to their general trade in feedingstuffs and fertilizers. A large proportion of the trade is handled by this latter group of merchants, who obtain their supplies from the various wholesalers and also handle cereal and herbage seed in season.

Retail trade

The retail vegetable and flower seed trade is basically divided into three groups of traders:

1. The pictorial seed packers, who distribute illustrated packets through a multitude of shops and stores up and down the country, selling the seed under their own brand name and frequently doing the business on sale-or-return terms.

2. The counter seed trade, which is represented by a diminishing number of specialists handling seeds, seed potatoes, flower bulbs and horticultural sundries, frequently in conjunction with bedding plants and other nursery stock. The rising costs of rents and rates have had an adverse effect on this type of business because of its seasonal character, and to equate the income, many other lines, sometimes far removed from plant life, have been added to the seedsman's trade. The result is that in most cases seeds are now a relatively small proportion of a shop's sales by value.

3. The mail order trade is carried on by a limited number of national firms, selling by catalogue and advertisement throughout the country. These houses, whose trade is concentrated into peaks of activity, are finding considerable difficulty in coping with the rising costs of postage, printing, etc., and it would appear that the proportion of trade in the country done by them is steadily contracting.

Until very recently the majority of the seed businesses were one-man and family concerns, frequently private limited companies. One might almost say that the Stock Exchange list is notable for almost a complete absence of seed companies with quotations, but in the last few years there have been more public companies formed and in the last twelve months a definite sign of some groupings taking place. I expect to see this tendency develop.

Winter Feeding of Dairy Cows

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Professor Holmes looks at feeding costs in milk production and shows from experience at Wye that high yields are not dependent upon large quantities of concentrates.

WITH the increasing pressure on profit margins in milk production, attention must again be directed to factors influencing profitability. Food usually accounts for over 60 per cent of the cost of milk production, and although other factors, such as labour organization, deserve careful attention, food costs can often be reduced. Although the economy of milk production can be considered properly only on the basis of a whole year, winter milk production incurs a greater proportion of high cost feeds than summer production and is particularly deserving of attention. This article therefore refers primarily to winter production, although the principles can apply to summer production too.

Any rational cow diet includes some bulky feeds which are generally cheap, costing around 2*d.* per lb starch equivalent (S.E.), and some concentrate feeds costing from 2½*d.* to 4*d.* per lb S.E.; it is almost impossible to feed dairy cows entirely on concentrates, and it is rare in this country for bulky feeds to provide the total winter diet. The important question is, therefore, the relative proportion of concentrates and bulks to be fed. It is not merely a question of finding the cheapest available diet, since diets of higher quality and higher cost generally give higher milk yields while, on the other hand, bulk feeds often produce lower yields. The influence of the different types of feed on output per acre and total farm output are also important.

Some of these questions were considered by Barnard and Scott (1960) in their examination of the costs and returns of (*a*) bulk-fed herds (receiving 2¼ lb concentrates per gallon), (*b*) traditionally-fed herds (4 lb per gallon) and (*c*) high-yield herds (4 lb per gallon). They concluded that with low-yield but low-concentrate herds (i.e., those on bulk feeding) profit per cow was satisfactory, with low-yield high-concentrate (traditionally-fed) herds profit was poor, while with the high-yield high-concentrate herds profit was satisfactory. None of the herds examined fell into the low-concentrates high-yield category but the authors suggested that this combination would produce the greatest profits.

The achievement of high milk yields with low concentrate consumption has been one of the aims of experiments which have been carried out with the Ayrshire herd at Wye College over the past six years, and during this period cow lactation yields have averaged 1,000 gallons with an average concentrate consumption of 1·8 lb per gallon of milk. The yield per cow in herd has not been quite so high (900 gallons), but this is explained partly by increases in the numbers of heifers and by some infertility in the middle years of the period. The purpose of this article is to discuss the principles underlying the attainment of this performance and to outline practical methods of achieving it.

Securing high milk yield with low concentrate consumption depends on (*a*) the use of cows with high genetic potential for milk yield, (*b*) the production of high-quality bulk feeds and (*c*) the efficient balancing of bulk feeds and concentrates throughout the lactation.

Recent studies have shown that, with rare exceptions, genetic quality is fairly uniformly distributed throughout British dairy herds and that the widespread use of A.I. is likely to increase this uniformity. The production of high-quality bulk feeds is a skilled operation frequently described in this and other journals but still subject to the influence of stage of growth and efficiency of conservation. In the present article reference can be made only to the magnitude of the variations which may occur.

The efficient balancing of bulk and concentrates throughout the lactation period depends on an understanding of the variations in appetite and in nutrient requirement which occur during this period. The views expressed here are based on limited data and some still require verification. Nevertheless they provide a rational basis for a system of feeding which has proved effective at Wye.

Factors affecting appetite

The quantity of feed, expressed as dry matter (D.M.), consumed by a cow depends both on the quality (most simply expressed as concentration of starch equivalent (S.E.) in the dry matter of the feed) and on the size and metabolic activity of the cow. The higher the quality of the feed the greater will be the amount eaten to satisfy appetite. For example, in an experiment at Wye milking cows consumed about 36 lb D.M. per day on a diet containing 57 per cent S.E., while similar cows were satisfied with 27 lb D.M. from a more bulky diet with 49 per cent S.E. in the D.M. The quantity of indigestible organic matter, or ballast, consumed was similar in both rations at 9·2 lb, and it is probable that the ballast content of a diet is a major feed factor influencing appetite. In consequence, only when bulky feeds are of high digestibility and S.E. concentration can they be expected to encourage a large total consumption of nutrients.

In addition to feed factors, however, the cow's appetite, whether as D.M. or as indigestible organic matter, is also affected by her size and her milk yield, and possibly by other, as yet ill-defined, influences. Within the range of 800-1,400 lb live weight, the dry cow's appetite for dry matter will increase approximately from 21 lb to 27 lb per day, i.e., about 1 lb per 100 lb live weight. Metabolic activity as indicated by milk yield also affects appetite so that, in conditions where a 1,100 lb dry cow will eat 24 lb D.M., a cow yielding 50 lb milk may take 38 lb. The influence of pregnancy appears to be small but is not yet well understood, nor is it known whether stage of lactation apart from associated milk yield has any effect on appetite.

Nutrient needs

In contrast to these variations in appetite, the nutrient requirements in terms of starch equivalent vary as far as is known, in a different way. No reference is made to protein requirements, since it is rarely difficult to meet these. The maintenance requirement depends on live weight but may also vary to some extent with metabolic activity and be relatively greater when

milk yields are high. For a few weeks before calving it is considered that there is a pregnancy requirement which may rise from 2-8 lb S.E. per day over the last four weeks. Just before, and at, calving there is limited evidence for a restriction of feed intake to encourage mobilization of mineral reserves. After the cow has calved and cleansed, and lactation is well established, nutrient needs rise quickly, and a high level of feeding is desirable to stimulate maximum milk production.

After the peak yield has been reached, commonly by the sixth week of lactation and seldom later than the tenth week, nutrient needs decrease with declining lactation. Unless steps are taken at this time to reduce the supply of energy with the fall in milk yield serious waste of feed can occur, since, on a good diet, a cow's appetite may then exceed her nutrient requirements. Although excess nutrients will be stored as live weight, this can be expensive on winter rations.

These variations in appetite and in nutrient requirement over the lactation are shown in Fig. 1 (p. 415). From this it can be calculated that while, when dry, the cow requires a diet with about 45 S.E. in the dry matter, at peak lactation she needs about 65 S.E. After this the concentration required in the diet gradually declines. The precise concentrations depend on many factors but the general relationship is as shown.

The secret of effective bulk feeding depends on the exploitation of this variation so that when nutrient needs are high bulk feeds are well supplemented with concentrates; and when they are low, few concentrates are fed and bulk feeds are expected to make a larger contribution.

Practical application

An example of a scheme of feeding which embodies these principles is shown in Fig. 2 (p. 415). It should be stressed that the scheme assumes that the main bulk feed is fed *ad lib.*, a practice which is becoming increasingly common as self-feed and free-feed systems extend. It should also be noted that the size of the shaded areas which indicate the contribution above maintenance that can be expected from bulk feeds, will depend on the *quality* of the bulk feeds available. Commonly 10 cwt cows will take 20-25 lb of dry matter in the form of silage or hay in addition to some concentrates. This quantity could supply nutrients for maintenance and over 2 gallons if provided from kale or good silage, maintenance and one gallon if the silage is of poor quality or if hay is the main source of bulk. If poor hay, or wet or badly-fermented silage is used no more than maintenance may be provided. The level expected from bulk feeds must therefore depend on careful assessment of their quality.

Figure 2 shows the plan when the basic bulk ration is capable of providing (*a*) maintenance and 1 gallon or (*b*) maintenance and 2 gallons. It also shows that where high-quality bulk feeds are used there is little need for concentrates for steaming up. Indeed in experiments at Wye where high-quality bulk feeds were used there was no advantage at all in providing concentrates before calving, although they were worth while when only poor silage was given before calving. To accustom the cow to the concentrates which she will receive after calving, and to ensure that she is supervised as calving approaches, it is generally wise to feed some concentrates (say, 3-6 lb per day) for the last 14 days before calving. Prolonged steaming up before calving

is best avoided, since it can cause serious waste of concentrates if calving is delayed. In considering steaming up, attention must also be paid to the condition of the individual cow; a cow in poor condition is more likely to benefit than one already in good condition at the end of her lactation.

After calving a high concentration in the diet is ensured by expecting a lower contribution from bulk feeds (M + ½ or M + 1½ gallons in the examples) and providing the additional nutrients from concentrates at the normal rate (say 4 lb per gallon) above that level. This is the time when the total lactation yield is largely determined, and all skill in management, milking and feeding should be devoted to encouraging a high peak yield. By the tenth week after calving, diet concentration can be reduced by increasing the expectation from bulk feeds and making a corresponding reduction in concentrates offered. A further reduction can be made 18-20 weeks after calving. When winter feeding comes to an end and pasture is again available, an even greater proportion of feed can, of course, be derived from grazing and concentrates then rarely give a worthwhile increase in milk yield.

Examples of winter feeding

Two examples of winter feeding may be quoted. The first instance assumes self-feed silage or that silage is provided *ad lib.* in troughs. If this silage is of such quality that 22 lb of it as dry matter (80-100 lb of silage) can provide maintenance and two gallons, the cow six weeks calved yielding six gallons per day would be fed above 1½ gallons and receive 18 lb concentrates per day. By the eighteenth week of lactation, however, when her yield might be 4 gallons, maintenance and 2 gallons could be expected from bulk feeds and her concentrate allowance would be only 8 lb. On this basis, a low-yielding cow giving 2 gallons or less would receive no concentrates. But when most of the cows in the herd are receiving concentrates it may be considered psychologically unsound to withhold them from some of the animals, although this can be done. Since specially formulated concentrates are often the best means of providing minerals for the cattle, it may be prudent to give a basic minimum concentrate allowance of, say, 2 lb per day during the winter months, which would in this example be given to cows giving 2½ gallons or less.

In a similar example, where good hay and roots were providing the bulky feeds, maintenance and one gallon might be expected on average. In early lactation maintenance plus ½ gallon only should be expected so that a six-gallon cow would receive 22 lb of concentrates. The four-gallon cow might, however, be expected to obtain the first gallon from bulk feeds, so that 12 lb of concentrates would be her allocation, and again later in lactation the two-gallon cow would require 2 lb of concentrates.

Another modification of the same principle, which has been adopted by a farmer feeding hay and roots as his basic ration, is to feed a high quality (3½ lb per gallon) concentrate for the first ten weeks after calving and a cheaper, home-mixed concentrate (4-4½ lb per gallon) subsequently.

Feed to yield

Before the scheme outlined, or any other orderly scheme, can be implemented it is necessary to know the milk yield per cow and to be able to allot

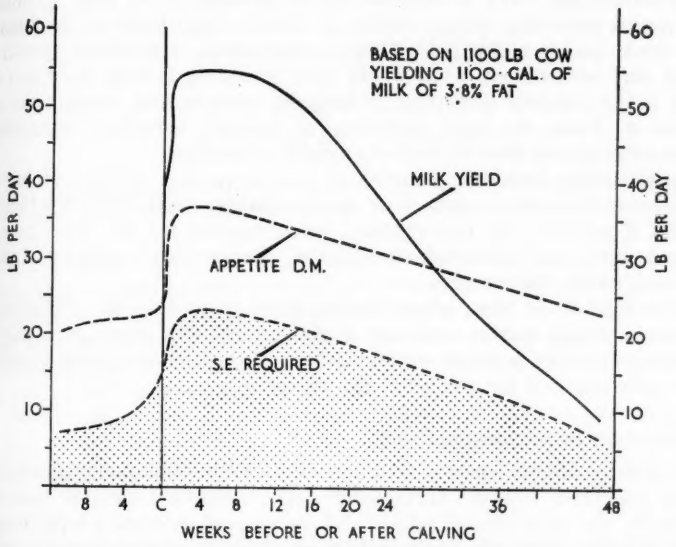

Fig. 1. The relationship between milk yield, appetite and nutrient requirement as S.E.

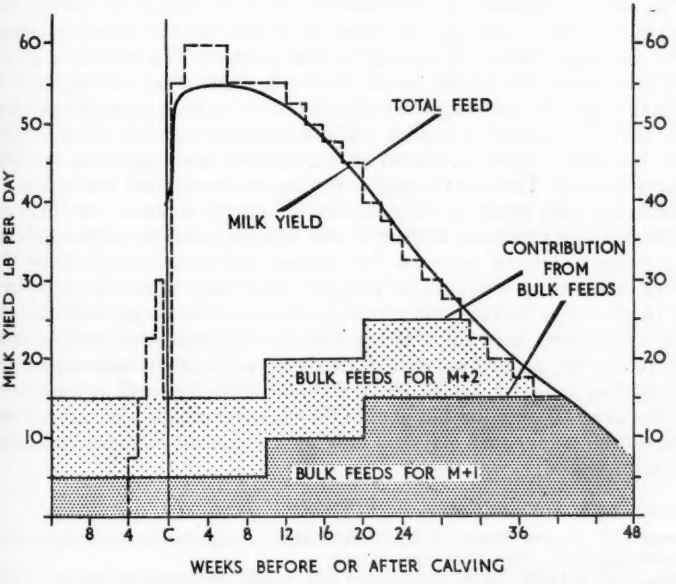

Fig. 2. Feeding scheme showing variation in concentrate and bulk feed with stage of lactation.

feed accordingly. Milk production can be assessed by (*a*) daily recording, (*b*) weekly recording, taking weights on the day least liable to variation in the week, or (*c*) at the risk of some inaccuracies, a standard pattern of yield may be assumed. Even where daily recording is done it is rare for feed to be adjusted according to butterfat content and inaccuracies are common. From the yield estimates or records, individual concentrate allowances should then be made by weight or measure.

In allocating feed, the grouping of cows according to time of calving whether in byres or in yards, is of great assistance. Bulk feeds can then be varied if required, the best qualities being reserved for the most recently calved cows, and individual allocation of concentrates is easier and more accurate within the batches.

It will be noted that, where feeding takes place only at milking time, unless very high quality feeds are available the heavy concentrate feeding suggested in early lactation would be difficult to apply in a milking parlour with only one stall per unit.

Effects on milk composition

Studies on the influence of feed and feed level on milk composition have been associated with the experiments made. Broadly it may be said that butterfat was little affected by diet. All diets tested included a high proportion of bulky feeds, which generally maintains a fairly high butterfat level. Butterfat percentage was depressed only where large quantities of starchy concentrates were fed. Steaming up rarely had any beneficial effect on this percentage, and where it occurred it lasted only a few weeks after calving.

The main constituent of solids-not-fat which is affected by feeding is the protein. This was unaffected by steaming up and current nutrition appeared to be the major factor influencing protein content. The protein content of milk consumed falls to its lowest level 6-8 weeks after calving and then gradually rises 0·1 to 0·2 per cent by the end of lactation provided the cow is in calf. The system of feeding recommended, where feed level is high in early lactation, helps to counteract the normal early lactation decline in protein content. The more stringent feeding recommended towards the end of lactation may result in some decline in protein content, but there is no justification for expensive feeding at this time to maintain milk composition until some system of payment for composition is instituted. Even if the farmer was getting low s.n.f. in the herd bulk milk, it would be better for him to give extra feed to cows which were at an earlier stage in the lactation.

In conclusion, high milk yields with low concentrate feeding can be achieved by the production of bulk feeds of good quality and the adoption of a feeding system in which bulks make a relatively small contribution to the diet at peak lactation but supply the majority of the feed at later stages of lactation. Under such a system milk of satisfactory chemical composition can be produced.

References

BARNARD, C. S. and SCOTT, A. H. (1960). Milk on the arable farm. Rep. No. 51. Cambridge Univ. Farm Economics Branch.

BARNARD, C. S. (1960). Milk, management and money. *Agriculture* **67** 421-2.

Jersey Agriculture

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Tourism has made important changes in the nature of farming in Jersey, particularly as regards meeting the heavy demand for summer milk.

VISITORS to the delightful island of Jersey are not only impressed by the magnificent coastline with its many sandy bays, but also by the intensity of cropping and the attractive design and durability of the farmsteads. This last fact indicates that farming was at one time prosperous and indeed until the last decade it was the main "industry" of the island. Now it takes second place to tourism as a source of revenue.

Jersey, the largest of the Channel Islands, measures approximately 45 square miles. Nowadays less than half of this area is cultivated, partly because a proportion of the more difficult land, once cultivated by hand, has gone out of production. Over the last seventy years the area of agricultural land under cultivation has decreased by almost 30 per cent to the present figure of just under 14,000 acres. Over the same period of time the resident population has risen by 16 per cent. At the height of the summer, however, the resident population is doubled by visitors and this has a direct bearing on the agricultural policy, especially as regards the supply of fresh milk.

The island is governed by its own parliament, or "States", which appoints a committee of seven to deal with agriculture. The present committee is trying to prepare a policy which will give the farmers some measure of protection and confidence. At the time of writing there is no security of tenure, or compensation to a tenant for improvements or unexhausted manures. In the near future, however, subsidies of up to 60 per cent will be paid for lime and approved chemicals to control certain soil pests. Guaranteed prices or producer subsidies do not exist, except in the case of milk, where the price to the producer is fixed by the Jersey Milk Marketing Board and Committee. The average price paid for milk is slightly under the average cost of production.

There is no clear-cut distinction between agriculture and horticulture, as for example in Guernsey, where there are two separate States Committees, and the two main products are milk and glasshouse tomatoes. In Jersey the average size of holding is only 8 acres; there are over 600 with less than 4½ acres and just over 200 with more than 22½ acres. Over the last few years there has been a gradual reduction in the number of occupiers. In 1954 there were 1,970 and on 1st August, 1960, only 1,677. The number of milk producers fell from 960 in January, 1955, to 793 at the present time. By and large, cattle are kept on larger holdings. The average size of these is about 15 acres, and it is with these "farmers" rather than the more specialized horticulturists or "growers" that this article is concerned.

*Mr. Hosken completed his three years of seconded duty in Jersey at the end of August.

Farming for milk

The Jersey breed is known throughout the world as a specialized dairy animal producing a very high butterfat content milk, and high yield in relation to body weight. For nearly 200 years (since 1763) the breed in the island has been kept pure; importation of live cattle is forbidden by law. Naturally, during the war-time occupation by the Germans, for five years cattle exports ceased and all forms of agriculture suffered a considerable setback. The years immediately after the war saw a brisk trade in the export of cattle, but this was followed by a recession and the position has improved only slightly during the last year. This improvement may be partially due to an extended runway at the airport, which enables large aircraft to land and fly direct to America in a matter of twelve hours. The average number of cattle exported over the last few years has only been 500 per year and many of these have realized only moderate prices.

The history of cattle exports has resulted in a great deal of time and attention being devoted to cattle shows where judging is on traditional lines. There are parish shows in May and October, followed by the Spring and Autumn Island Shows, with an additional show in August.

The number of breeders who can claim to make a living from the sale of cattle to overseas buyers is small. The majority of the farmers must now therefore look to milk production rather than cattle sales as a source of profit.

The following table shows that over the last eight years the number of cows has remained more or less constant. The number of followers has dropped, and there has been a steady increase in the amount of milk collected by the dairies. This indicates a higher yield per cow, less milk fed to calves and possibly less milk consumed by household and staff.

	Cows and heifers in milk	Heifers (all ages)	Bulls over 12 months	Gallons of milk collected	Gallons sold per cow
1939	4,853	4,448	152	No record	—
1946	5,199	3,470	110	—	—
1953	5,603	4,964	174	2,481,772	442
1955	5,627	4,744	168	2,630,063	467
1957	5,572	4,091	143	2,854,700	510
1959	5,729	3,789	131	2,938,122	516
1960	5,570	3,886	153	3,033,018	545

The average yield per cow has risen from 611 gallons in 1953-54 to 650 gallons in 1960-61. Thus, although the improvement in milk yield has been encouraging, the increase in milk sales per cow has been most marked.

Most of the cattle farmers are to be found in the northern half of the island, where the soil is a useful medium loam containing a large proportion of silt. There is a good depth of soil over most of this area and it is free draining, very productive, but very acid and low in organic matter. From a few feet above sea-level in the south and south-east, the land rises to 450 feet in the north, and it is this southerly aspect with well-sheltered valleys which provides excellent conditions for growing early potatoes.

The climate is very mild, frosts are rare, the average annual rainfall is 33·25 inches, and the average annual sunshine figure is 1,913 hours. This type of climate encourages the growth of grass almost throughout the year,

and consequently continuous grazing is practised. Tethering is still common (only about one-third of farmers use electric or any type of fence), with the result that the grass is very closely grazed and recovery is slow. Another disadvantage of this system is that the cows do not have access to water, which is especially important in hot, dry summers.

Other livestock

There is only one small flock of 40 sheep, and (in 1960) only 112 goats. The pig population is at present lower than it was in 1939 and considerably lower than the immediate post-war period. In 1960 there were 462 sows being kept for breeding, out of a total pig population of 2,537. Pig-keeping in the island suffers the disadvantage of having to compete with imported pork and bacon which receives a guaranteed price in the United Kingdom.

The majority of the poultry is kept in a number of relatively large units, there being 45,000 fowls (over 6 months) and 81,000 broilers and table chickens in 1960.

The number of horses used for agricultural purposes continues to fall, the latest recorded being 453, as against 1,258 in 1939.

Land rentals are extremely high by English standards, being between £12 and £30 per acre on most cattle farms, so that the farmer has to make the most of his land by double cropping and producing crops which will give him the highest returns. Besides the early potatoes for which the island is noted, considerable areas of broccoli, anemones and gladioli are now grown on the general farm. This restricts the area which is available for grass and consequently stocking is very high.

Greater interest in grass

In spite of the high intensity of stocking, full production from grass is not achieved and a good deal of concentrate is used. By means of grassland recording at the States Experimental Farm and elsewhere the benefits of increased production from properly managed grass are demonstrated. On average over the whole island there is less than 1 acre of grass available per cow equivalent, but on the States Farm grassland recording has shown that this stocking rate can be doubled, while using only 14·92 cwt purchased concentrates per C.E., compared with the average of just under 17 cwt per C.E.

At the States Farm, yields of 33 and 38½ cwt per acre Utilized Starch Equivalent were obtained from predominantly ryegrass leys, while on Bagot Manor Farm, 33¾ and 34¾ cwt per acre U.S.E. were obtained from timothy-fescue, and lucerne leys respectively. Permanent pastures yielded 24 and 15½ cwt per acre U.S.E., the latter being poorly drained. These figures show that pastures which are well managed and adequately fertilized can produce very satisfactory yields. A summer drought can, however, adversely affect production, and the 1959 yields were much lower than those for 1960 quoted above. In 1959, timothy-fescue yielded 27½ cwt per acre U.S.E. and ryegrass 24½ cwt per acre.

Although the cattle on both farms were grazing for ten months in the year, production of U.S.E. was confined to six or seven months only—i.e., March-April to October. During the other months cattle were getting their maintenance and production requirements from other foods, and the pasture

was used solely for exercise. In an average year cattle can be turned out to early bite during the first fortnight in March, provided the pasture has had at least two months rest and a top dressing is applied in late January.

There are very few farmers who have a sufficient area of grass to make silage, and often heavy hay crops are taken to the detriment of the sward, as early haymaking clashes with the lifting of the early potato crop.

Every year more and more farmers are seeking the advice of the Agricultural Adviser on the management of grassland and, while there is plenty of scope for improvement on many farms, grass is at least being treated as a crop and not just something which grows without attention.

Second crops

A number of different crops are grown as second crops after early potatoes, and of these Italian ryegrass for late summer and autumn grazing is extremely valuable. Other second crops are grown especially for winter cattle food, such as mangolds, kale and turnips, with hybrid maize for silage as a recent introduction. Variety trials of maize at the States Farm, sown last year on 31st May, yielded 20 tons per acre of finished silage with a dry matter of 20 per cent. Harvesting took place during the first fortnight of October. Of the varieties tried in 1960, Caldera 402 proved to be the most suitable for sowing in late May, Pioneer 395 and Maize King V for earlier sowing. Maize is not a new crop to the Jersey farmer, however, as a small area is sown broadcast on many farms for green food as an insurance against a late summer drought.

There has been a sharp fall in the area of cereals grown since the war because these crops are uneconomic to grow. In 1946 there were 2,220 acres of cereals but in 1960 only 474 acres.

Many farms cannot produce enough hay for their winter requirements, and consequently this has to be imported either from the United Kingdom or Norway. The average annual quantity imported over the last few years has been 1,500 tons. Importation of concentrated cattle foods amounts to 5,500 tons a year, of which about 1,000 tons is dried sugar beet pulp. All fertilizers and lime have to be imported; hence the utmost use is made of liquid manure and farmyard manure, which are carefully conserved on every farm. Considerable importance is attached to the regular use of large dressings of F.Y.M., and where it is thought that insufficient is available *vraic* (seaweed) is used. This is obtained from the beaches whenever available throughout the year. A modern plant has been provided by the States for processing refuse and sewage sludge into compost.

The average number of cows per herd has increased to about seven, and 40 per cent of the herds are milked by machine. Many holdings in Jersey are fragmented, consequently a number of farmers find it more convenient to milk in the field during the summer months rather than lead the cows back to the farm.

Most of the work on the farms is carried out by the farmer and his family, frequently working long hours, but French labourers work throughout the year on a number of farms, whilst many more come over only for the potato and tomato seasons.

The author wishes to acknowledge the help of G. G. Bulman, B.SC., recently seconded to Jersey, in the preparation of this article.

The Future of the Turkey Industry

RAY FELTWELL

In this forward-looking article Mr. Feltwell, an acknowledged expert on turkeys, calls for new thinking and a planned approach on the part of farmers, merchants and manufacturers in the development of a progressive British turkey industry.

THE next ten years are likely to see a tremendous increase in the number of turkeys produced in the United Kingdom and these will reach the housewife under brand names at relatively lower prices than those prevailing today. The trend towards intensive methods will continue at an increased pace and the problems of lower prices will, to some extent, be offset by more efficient methods of production and marketing.

One of the problems to be faced will no doubt be the threat, and on occasions the reality, of retail prices reaching such a level that turkey production becomes uneconomic for many producers. In the main these will be those farmers who have been unable to re-equip themselves for modern production, those who have failed to keep accurate records of performance and those who have dealt with the question of marketing in a haphazard manner.

It will be clear, therefore, that in my view we have now said goodbye to the lush days of high profit margins, during which time it was often possible to make money from turkeys without paying much attention to the best methods of husbandry, production costs, or giving any real regard to the problem of sound marketing.

An essential ingredient for the establishment of the British turkey industry on a firm, stable foundation is the elimination of the "gambling" element from all branches of the industry. It is the duty of all concerned—the farmer, the food merchant, the housing and equipment manufacturer and the packer —to do their utmost to enable the industry to develop on sound lines.

Group approach

The coming years will see considerable development of the group approach to production and marketing, and the turkey industry, together with the table chicken industry, will continue to lead the agricultural revolution along the paths of integration. Voluntary limitation of production may from time to time be required. Careful planning is necessary; unit size will increase and only the carefully planned and integrated units will stand the best chance of success.

The group approach calls for discipline. To succeed, the turkey industry must become far more highly self-disciplined than it has been in the past and agreements made must be honoured. Personally, I do not define descipline as dictation by sectional interests but agree with the suggestion that discipline is ordered guidance, not repression.

Integration within the turkey industry is here to stay, and the wise farmer will accept this challenge and play his part in helping to shape the future of

the industry. Much of value can be gained by studying the manner in which the table chicken groups have developed, and there will no doubt be some important lessons to be gained by studying the table chicken groups that have failed. Producers should play an active role in the organization of groups in order to safeguard their interests.

Integration does not necessarily mean that the farmer's individuality need be lost. The role played by the farmer will undoubtedly change and the successful farmer will be the one that recognizes the need and makes preparations to fit his enterprise into the change in pattern. The farmer, with some exceptions, will no longer be called upon to be responsible for all aspects of turkey production, i.e., breeding, processing, marketing and distribution, but will be able to concentrate on production, leaving the marketing side to his group associates.

Security is the main advantage of the group idea and this is achieved by co-ordinating marketing, often under a brand name and by establishing an equalization fund. By working together, savings can be made in production costs and the increased numbers of turkeys available give a greater opportunity for market flexibility. In addition, the group is able to keep its members abreast of the latest developments in husbandry and provide a costings service.

The British turkey farmer is traditionally independent and the question immediately arises as to the future of the small farmer who does not wish to become associated with the group. In the turkey industry there can be no doubt that the small farmer, as distinct from the small-minded farmer, will still play an important role. Such farmers producing turkeys primarily for the Christmas market in fresh killed birds will exploit the undoubted antagonism felt in some quarters to frozen turkeys. In many cases it will be the farmer's son or daughter who is responsible and who arranges for the turkeys produced to be sold direct to the housewife or to the shops. In this way profitable production can be achieved. There is, however, a limit to the number of turkeys that can be dry plucked on one farm for the fresh Christmas market, and this will ensure that only relatively small numbers of turkeys are marketed in this manner.

Marketing

I have already said that in my view many more turkeys will be produced in the coming years than in the past. However, it is important to ask: "Where will all the turkeys go when they are produced; Is the demand there and if so where; and What is the demand for"? It becomes clear, therefore, that there is an urgent need to know whether in fact the housewife and her family do want to eat turkey all the year round, and if the answer is in the negative how can she be persuaded that she *ought* to eat turkey all the year round, and what will the cost of persuading her amount to? Certainly a considerable sum of money will be required and the industry must be congratulated on the amount of money already raised for publicity purposes.

One thing is certain, however, and that is it should not be assumed that because the table chicken industry has been successful in changing the eating habits of the nation it will also be possible for the turkey industry to do so as well.

It is absolutely vital to create a demand for turkeys in advance of supplies, and the wise turkey producer will have his marketing arrangements made by the time the day-olds arrive on the farm.

An important feature of the future will no doubt be a rapid development of supermarket buying by the housewife, and there is every indication that supermarkets will change the buying habits and, therefore, the eating habits of the nation.

The trend towards self-service stores and supermarkets will advance hand-in-hand with brand-name selling. The retail outlets will demand quality turkeys because they will be forced to supply the type of turkey demanded by the housewife. Every year more and more whole and cut-up turkeys will be sold under brand names.

Groups are able to cater for the supermarkets' demand for regular supplies of high quality turkeys and thus have a distinct advantage over the individual "go it alone" farmer. Generally, the demand will probably be for oven-ready frozen turkeys of from 5 to 12 lb and for cut-up turkeys. With careful point of sale publicity, this demand could no doubt be built up into a satisfactory all-the-year-round trade.

There is every indication that the standard of living will rise over the coming years, and as the standard rises the trend will no doubt be towards eating out. In the coming years, therefore, turkeys will make far more regular appearances on restaurant menus. So the catering trade can be expected to demand larger and more broad-breasted turkeys in the weight range of 20 lb and upwards. The catering demand is already on an all-the-year-round basis and the indications are that this demand will increase.

Thus, in my view, there is a reasonable possibility of three definite markets developing during the coming years. Firstly, the self-service frozen oven-ready whole and cut-up turkey, secondly, the large catering bird and finally the Christmas turkey when the better finished bird will no doubt reap its reward in higher prices. Many of the Christmas turkeys will be fresh, as opposed to frozen birds.

The packers have an important part to play in building up the reputation of the British turkey industry. Careful processing and packing is an essential ingredient for quality turkey production, and this must be coupled with proper presentation and brand name selling.

Unfortunately, modern methods of processing are so efficient that inferior turkeys can often be made to appear most attractive when frozen and wrapped. It is only when the unsuspecting housewife thaws out the bird at home that she is able to discover the truth. Brand name selling will in itself help to improve quality, but in addition there is need for standardization and improvement of packing station technique. I foresee agreement being reached between packers regarding the amount of "moisture uptake" during processing and furthermore the coming years will doubtlessly see the introduction of some form of veterinary inspection at packing stations.

Impact of "One Europe"

It is impossible to take a view of the future without considering the impact of the turkey industry which the introduction of a common European agricultural policy might bring about. The arguments put forward in favour of

integration within the poultry industry can, in my opinion, generally be applied in favour of our joining a "One Europe" group of nations.

My view is that the efficient turkey producer has no need to feel alarmed if the Common Market is expanded to include the United Kingdom and other countries. I feel that we have the knowledge which will allow us to produce turkeys on equal terms in competition with any one. I stress *equal* terms, for the very concept of "One Europe" presupposes a common agricultural policy and a common import policy that will effectively remove the threat of dumping.

The market potential for good quality turkeys sold under well-advertised brand names in "One Europe" would be enormous, for the combined market would be greater than the market available in the U.S.A. The possibilities are most exciting and there would also be very great prospects for those breeders able and willing to embrace Europe as their sales area.

In return for entry into such a market, the British turkey farmer would also have the duty of helping his European colleague. By and large, the European farmer still has a long way to go by way of re-equipping before successfully making the fullest use of the latest technical developments and additions to scientific knowledge. The British farmer will, therefore, be able to play a vital role in raising the standards of turkey husbandry throughout Europe, a role that could easily expand the British Turkey Federation into a European Turkey Federation.

Costs of production

Another of the developments that I foresee in the coming years is the need for absolutely reliable statistics regarding costs of production. Each year will increase the need for farmers to know exactly how much has been invested in their turkey unit and how much money has been made. Groups will help in the collation of records, and farmers will tend to compare their results one with another.

In this connection the result of accurate record keeping will undoubtedly be that farmers will tend to adopt the most profitable forms of housing and to purchase their stock and feedingstuffs on the basis of food cost per pound of meat produced. It is not the initial price of the house, the day-old poult or the price per ton of food used that is of special importance but the final profit margin calculated on every £1 invested in the project.

The trend will, therefore, be towards the sale of high quality stock, often the result of cross-mating, that has a proven ability to grow rapidly with first-class fleshing qualities. The "back room" necessary to carry out such a policy of breeding can be a rather costly undertaking, and no doubt many small "breeders" will disappear and be replaced by a few breeders of international repute who will not only supply day-old poults but also male and female replacement breeding stock.

There is certainly an urgent need for the production in regular numbers of far better quality poults than are generally available today. The price range for day-old turkeys is at present very wide and frequently day-olds are purchased which turn out later to be quite different from the manner in which they have been described at day-old. The failure to deliver the goods will help in the consolidation of the best of the large breeding organizations, and

will give impetus towards the purchase of breeding stock for breeding on the farm of the larger turkey grower.

In order to supply day-old poults at all times of the year, the intensive housing of breeding stock will become a necessity and new standards of management and husbandry will be required. The trend will certainly be towards rearing turkeys in windowless houses following a well-planned lighting programme so as to persuade the turkeys to lay their eggs at the time required.

There are many indications that more and more breeding birds will be housed in laying cages, because of the very much better control that such methods of housing allows. Artificial insemination will, therefore, become far more widely used and in many cases will be the only means of maintaining fertility. However, more commonly, artificial insemination will be used as a boost to natural mating.

In the field of turkey feeding, the impact of accurate records concerning production cost will mean the end of buying "magic" formula turkey feeds. The enterprising turkey farmer will tend to buy carefully balanced rations of high quality, of a declared nutritional content and for which records of performance are available. Scientifically prepared rations, often more expensive in terms of price per ton but cheaper when considered in terms of food cost per pound of turkey meat, will increasingly replace the bags of mystery turkey foods that have often been purchased in the past.

One of the most important results on the keeping of accurate records of production on a group basis is that in the coming years it will be possible to establish just which are the most profitable and satisfactory methods of housing and management.

It is my view that the swing towards intensive methods will continue and that more and more turkeys will be raised in well-insulated and ventilated houses very similar in design to those used so successfully by the table chicken producers. The trend will be windowless houses in which the environment is carefully controlled at all stages, with the turkeys being killed at the weights required.

To reduce the risk of disease, it will be necessary to adopt the "batch" system, by which is meant one house for one age of bird, or even one farm for one age of turkey. Only in this way can the risk of infection be reduced to the minimum.

In conclusion, I am quite certain that in the future far more attention will be given to the design of equipment, and unscrupulous manufacturers (fortunately there are not very many) will be less able to pass on untried equipment at a high price that later turns out to be unsuitable and impracticable. The manufacturers themselves will tend to get together, and advice will become available on proven equipment. The trend to automation will continue and we shall see, in my view, a far greater use of bulk delivery and automatic methods of feeding and watering than in the past.

Fight against Bracken

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The resources of science continue to be pitted against the march of bracken, but unless the control gained can be followed up by sward and stocking improvement, an economic return is doubtful.

THE group of plants to which bracken belongs (the Pteridophyta) dates back some 350 million years to the Devonian period, and bracken itself has been on earth, more or less in its present form, for at least a million years. In this period it must have been attacked by viruses, bacteria, fungi, insects of all sorts, animals and latterly man. It has, over the ages, survived the attacks of all of them and we should not perhaps expect it to be easily eradicated now. The plant has become well attuned to its environment.

As Braid has pointed out in an excellent review of the literature, bracken is to be found world-wide. It occurs in the temperate regions of Africa, Asia, Europe, America and Australasia and is said to be almost as big a pest in New Zealand as it is in Britain. In European, and no doubt in other countries, bracken is essentially a shade-plant growing under trees, and the reasons for its control may be quite different from say, in Scotland, where it thrives on the open hillside, sterilizing great tracts of potentially good cattle or sheep grazing land. At one time it was utilized in Scotland for thatching, bedding and the like, and there is a record of its having been deliberately introduced into the Western Islands and parts of the mainland. With the "clearances" and the subsequent predominance of sheep grazing, bracken has spread unhindered; it was recently estimated that some half a million acres in Scotland are infested. This includes a possible increased infestation of 10,000 acres since 1943.

Bracken, in common with most other ferns, can reproduce itself by spores (which it produces in astronomical numbers) but although these spores can easily be germinated in the laboratory, young plants produced from spores are seldom found in the field. Such factors as drying winds, early frosts, and soil acidity are possible reasons for this, and Lousely has drawn attention to the invasion by bracken sporelings of bombed sites in Britain where rubble offered sterilized seedbeds of low acidity.

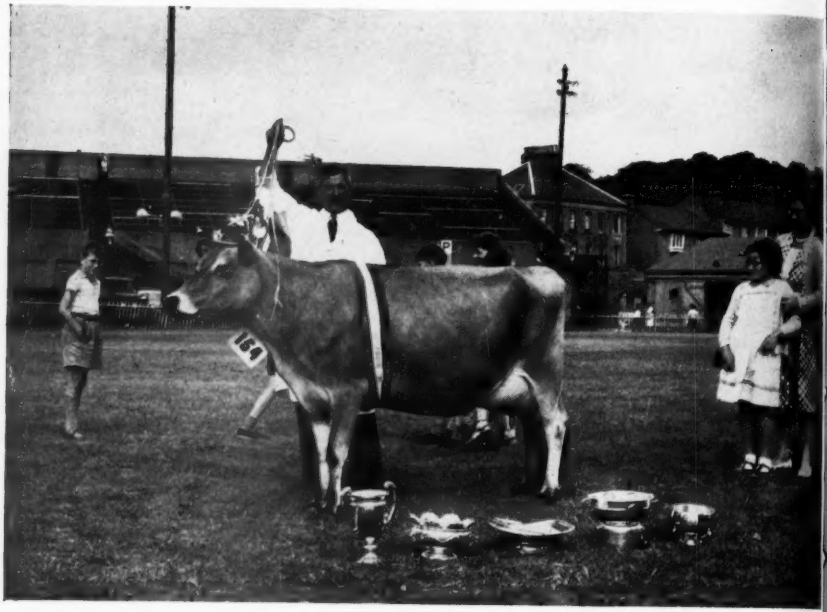
The main method of bracken spread is vegetative, by means of underground stems which store reserve food material and bear buds which will produce more rhizome below ground, or fronds above ground. Measured by weight, there is more of the bracken plant below ground (20-40 tons per acre) than there is above (6 tons per acre). The crux of the problem is to attack this underground rhizome, for although removal of fronds will temporarily eliminate the plant, new fronds arise from the rhizome a few weeks after cutting.

Attempts at physical control

Undoubtedly the best method of getting rid of bracken is by ploughing, followed by a potato or grass crop, but this is not always practicable on the steep hillsides. We have to resort to other methods.

Photo: *A. H. Marks and Co. Ltd*

Organic selective weed-killers may offer the means of controlling bracken.



"Royal Dainty Maisie", Supreme Champion and Senior Female Champion, August Island Show, 196

Milking in the field during the summer.

Photos: *E. E. Hoskt*

ey Agric on pp. 417-20)

Tethered cattle, no water available.

Photos: *E. E. Hosken*

Paddock grazing with adequate water.

American Ducks (Article on pp. 436-9)

Breeding pens at Research Station, Eastport, Long Island, New York.

Photos: *C. M. Ham*

Growing ducklings: approx. 3 weeks old

Most commonly the scythe is used, and although it can be effective it is slow work and therefore rather costly. Various cutting and bruising machines have been devised to do the job, and at Comrie in Perthshire four such machines were tested in co-operation with the Scottish Machinery Testing Station and the Economics Department of the College. The bracken was treated twice a year for three years (1952-54), followed by a single treatment in the fourth year (1955).

It is now possible to see the long-term effect of these treatments, and the results are summarized in the table below.

Effect of Cutting and Bruising on Bracken at Comrie, Perthshire
(*Results expressed as percentage reductions*)

	Implement	*Density*		*Height*	
		1956	1959	1956	1959
Cutting machines	Ferguson Mower	89	80	86	40
	Henderson Slasher	75	75	84	71
Bruising machines	Holt Breaker	75	0	81	46
	Cuthbertson Crusher	61	44	70	60

Clearly, in this trial, cutting was more effective than bruising, from the viewpoint of bracken regeneration.

What hopes do chemicals offer?

With the rapid development of organic selective weed-killers since 1945, thoughts turned naturally to the chemical control of bracken. Early experiments with 2,4-D, MCPA and the like indicated that these chemicals were not translocated to any degree. Later, Beatty[1] suggested the use of 4-CPA (4-chlorophenoxyacetic acid) for the control of bracken, and subsequent development of this chemical as a bracken herbicide was undertaken by Messrs. A. H. Marks & Co., Ltd., in co-operation with J. D. Forrest, formerly of our Department, and Dr. E. Conway, of the University of Glasgow. Trials were laid out at five sites in west Scotland and assessment of these trials the year after treatment indicated that 4-CPA in at least one of its several formulations showed great promise. This product was subsequently marketed as "Weedone Brackontrol". Although there was marked variation from site to site and according to the rate and time of spraying, reductions of some 90 per cent were reported in some areas.

At or around the same time, trials were being conducted on the Isle of Bute by the Mirvale Chemical Company, using their own formulation of 4-CPA, and we were invited to co-operate with them in the assessment of results. This material, too, showed great promise and was subsequently marketed as "Teridox".

Early trials with two other chemicals, Dalapon and Amino-triazole resulted in some diversity of opinion as to their utility as bracken killers. Trials by Conway[2] and Forrest[3] using ATA in the west of Scotland were not successful, whereas Bylterud[4] in Scandinavia reported successful reductions in bracken frond density. Fryer[5] using Dalapon, had found great variation in frond density reduction, the effect of the chemical seeming to be largely one of retarding frond emergence.

Standardized trials were laid down in Europe, Scandinavia and the United Kingdom in 1959, the aim being to compare the effectiveness of 4-CPA, ATA, and Dalapon for the control of bracken under a wide range of ecological conditions. The ARC Unit of Experimental Agronomy at Oxford set out trials throughout England and Wales. The results were reported by the Bracken officer, Dr. G. Hodgson[6]. In co-operation with this group we laid out two such trials and the results emphasized the necessity of applying chemicals at the correct stage of growth of the plant. Erskine's results[7] from trials laid out in the east of Scotland have shown a seasonal rise and fall in effectiveness of 4-CPA, there being a relatively short period of maximum susceptibility.

The occurrence and duration of this period may be related to the thickness of the cuticle, to the physiological state of development of the plant, and to the stage of development of the buds on the underground rhizome.

Susceptible period and environment

To make the problem even more complex, the time at which the susceptible period occurs varies according to such environmental factors as the nature of the growing season, aspect of slope, and altitude. All of these aspects are being investigated and may yield results applicable to a wider field than bracken.

The trials of 1959, like those of earlier years, showed great variation in effectiveness between sites, and Conway[8] has put forward a possible explanation. She points out that the branches of the rhizome system can be divided into three categories:

1. Thick ones that run deeply into the soil and are the main agents responsible for the outward expansion of the colony. Normally they carry few fronds or frond buds.
2. Thinner, smaller branches running near the soil surface: these are the main frond-bearing branches.
3. Intermediate branches linking (1) and (2) and capable of developing into either as environmental factors act on them.

She further states that closer examination of branches of type 2 at the end of a season show that these may be divided into two categories:

(*a*) Certain of the branches are those carrying expanded fronds with one or more frond-buds on the same axis—nearer to its apex.

(*b*) Intermingled with branches (*a*) are other similar rhizomes which carry frond-buds but no expanded fronds. These buds may remain in a healthy state below ground for an undetermined length of time.

Conway concludes that a high ratio of frond-buds on branches of type (*b*) will lead to extensive re-growth in the first year or two after any form of treatment. This implies that buds on type (*a*) branches, being adjacent to current year fronds, receive a lethal dose of herbicide, whereas buds on type (*b*) branches, having no adjacent fronds, are relatively unharmed and constitute the foci for regeneration of the plant.

Problem of applying chemicals

Another problem which is particularly important as regards bracken control in West Scotland is the method of applying the chemical. Both

helicopter and aeroplanes have been used in the experimental and commercial application of herbicides. Their success is rather dependent on the prevailing weather conditions and on the nature of the terrain. When a high wind is blowing the plane has difficulty in getting below 100 feet, much of the herbicide is dissipated over the surrounding countryside, and the dangers of drift damage to forestry plantations and agricultural crops are very real.

Bearing in mind the difficulties of mode and the time of application, thoughts have turned to herbicides which can be applied before the bracken fronds have come through. The advantages of such are obvious. Not only would it be less hazardous to cover difficult terrain when the ground is visible, but pre-emergence application could be carried out at a time when farm labour is not occupied with more urgent operations.

We have had some success with 2, 6-DBN (dichlorobenzonitrile) at 9 lb per acre (applied 1960, just prior to frond emergence), there being a 75 per cent control. Indications are, however, that control may not last longer than one year.

Trying out new chemicals

To test new chemicals, a system of co-operation between the West of Scotland Agricultural College County Advisory Service, farmers and ourselves has been adopted which enables widespread trials of promising chemicals to be carried out. A testing site has been established where chemicals are tried out on a small scale against bracken. (This year 16 were being "screened" in this way.) Those showing promise are included in "County trials" the following year.

This year County trials were carried out at seven centres in the College area, ranging from Eskdalemuir in Dumfries to Appin in Argyll, chemicals being applied both pre- and post-frond emergence.

Three chemicals being tested post-emergence this year at these sites are 4-CPA (4 chlorophenoxyacetic acid), at 5 and 10 lb per acre, ATA (Aminotriazole) at 3 and 6 lb per acre, and a mixture of 4-CPA/MPCA (1¼ lb/1⅞ lb: and 2½ lb/3¾ lb) per acre. (Doses are expressed as active ingredient.) These are applied monthly from June till August (inclusive). Three chemicals are also being tested pre-emergence, 2,6-DBN at 2½ and 5 lb per acre, 4-CPA at 5 and 10 lb per acre and ATA at 3 and 6 lb per acre. They are applied to bracken land monthly from February till May (inclusive). On the 2, 6 DBN plots receiving the high dose, no bracken has yet appeared although it is plentiful in the control plots.

Follow-up programmes

In previous publications (summarized in the recently published West of Scotland Agricultural College Bulletin No. 28) we have stressed the importance of a proper follow-up programme if bracken recovery is to be minimized, and to prevent recolonization of the cleared land by other weeds. This seems to be particularly important where the shading effect of a dense frond canopy has resulted in a sparse under-flora.

A post-spraying management trial laid down early in 1960 is being continued in co-operation with R. Gentles of the County Advisory Service,

Cowal. This experiment was superimposed on an earlier 4-CPA trial using "Teridox". Last year's results showed that removal of bracken litter by fire or mechanical raking did increase seed germination, but not subsequent sward yield. Lime and slag application, though not affecting germination, increased sown-sward yield; nitrogen applied as Nitro-Chalk did not. We have noted that there is a danger of young grass and clover plants being torn from the ground rather than severed by grazing ewes. This may prove to be a difficulty in the establishment of a grazing sward on friable bracken litter.

Follow-up trials on plots treated with the pre-emergence chemical 2,6-DBN have been laid down this year in co-operation with A. L. Gardner of the Grassland Husbandry Department, the West of Scotland Agricultural College County Advisory Service, and the Shell Chemical Company. Herbicide in the form of 2,6-DBN granules was applied in mid-February at the rate of 5 lb per acre. Two tons per acre of ground limestone and 1 ton per acre of basic slag were applied. A seeds mixture of perennial ryegrass (S 23) 15 lb, cocksfoot (S 43) 10 lb and white clover (N.Z. Cert. Mother) 1 lb was sown at monthly intervals after herbicide treatment and a top dressing of 3 cwt Nitro-Chalk given at time of seeding. Visual assessments indicate that indigenous grasses and sown grass seed germination are inhibited for as yet an undetermined period after herbicide application. This period seems to be at least 4 months in duration.

Biological control

A final aspect is the study of biological control. As already mentioned, bracken has few microbial enemies, but on occasion disease does break out, especially if damp, shaded conditions exist. One fungus, *Corticum anceps*, is known to attack under these conditions, and it may be that if mutation were stimulated by such processes as X-rays, a more virulent strain could be developed. This aspect is being investigated. Still on the subject of biological control, several cases of bracken dying off naturally have been reported, especially from Kirkcudbrightshire. It appeared that bracken stems, damaged initially possibly by grubs or sheep, were being infected secondarily by bacteria. Dr. E. Pike of the Bacteriology Department of the West of Scotland Agricultural College last year isolated three types of bacteria, but attempts to reinfect healthy bracken failed. Further outbreaks this year are being investigated.

As has been seen, this fight against bracken is being conducted by academic and commercial bodies alike, and the total financial outlay involved is considerable. Two questions must constantly lurk in the back of many minds: has the effort to date brought us nearer to the solution of the problem, and if the solution is found, will the return be economically worth while?

Need for more basic work

As may be apparent from what has been said, several important advances have been made in the field of chemical control, but in each case difficulties have arisen. In the case, for example, of the post-emergence herbicides 4-CPA, ATA and Dalapon, variability in effectiveness of the chemical between seasons and sites has led to the necessity of investigating factors

which will influence the optimum time of application. Again, with the chemical 2,6-DBN, applied pre-frond emergence, the residual toxicity of this material in the soil has led to unfortunate side-effects on the indigenous sward and germinating grass seedlings. In addition, early indications are that the chemical does not have such long-lived effect as we had hoped for.

Techniques such as the use of growth chambers, radioactive isotopes, and chromatography may have to be applied, if light is to be thrown on the correct stage of bracken growth at which chemicals should be applied. In other words, still more fundamental work is needed.

It is difficult to say whether, in the end, the work will be justified from the economic viewpoint. Nicolson[9] had pointed out that "although the acreage of bracken infestation throughout Britain is extensive, the area (of bracken) on the hill itself which could profitably be destroyed may be more limited than would at first appear to be the case". Further, he states that large-scale clearance is unrealistic without measures to improve the husbandry techniques which are the fundamental cause of its existence. To improve husbandry, capital must be available for reseeding treated land or improving existing swards. Stock, especially cattle, must be available to utilize this improved land and to prevent recolonization of cleared land by bracken.

Thus chemical spraying is only the first step. Unless capital is available to meet not only the cost of initial eradication of bracken, but to follow up with sward and stocking improvement, then it is unlikely that an economic return is possible.

References

1. Beatty, R. H. (1953). Proc. Inst. Div. Convention Amer. Chem. Paint Co. (Cit. Hodgson 1960).
2. Conway, Elsie (1959). The Bracken Problem. *Outlook on Agriculture II, No. 4*, 158-67.
3. Forrest, J. D. (1959). Effects of various Herbicides on Field Bracken (*Pteridium aquilinium*) *II Proc. 4th Brit. Weed Control Conf. 1958*, 184-9.
4. Bylterud, A. (1958). Chem. Control of Forest Weeds in plantations. *Norsk. Skogbe*, 4, 11. 347-56 (cit. Hodgson 1960).
5. Fryer, J. D. (1959). The effect of dalapon on bracken (*Pteridium aquilinium*) preliminary field trials. *Proc. 4th Brit. Weed Control Conf. 1958*, 189-93.
6. Hodgson, G. (1960). Dalapon, 4-CPA and Aminotriazole for the Control of Bracken —An Interim Report. *Proc. 5th Brit. Weed Control Conf. 1960*, 215-33.
7. Erskine, D. S. C. (1960). Interim report on Bracken Control Trials. *Proc. 5th Brit. Weed Control Conf. 1960*, 209-15.
8. Conway, Elsie (1960). Considerations in judging control methods of *Pteridium aquilinium. Proc. 5th Brit. Weed Control Conf. 1960*, 187-91.
9. Nicolson, I. A. (1960). Economic Aspects of Bracken (*Pteridium aquilinium*) in Upland Farming. *Proc. 5th Brit. Weed Control Conf. 1960*, 179-87.

Anaerobic Diseases of Sheep

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THE term "anaerobic diseases" is a convenient one to use to describe certain diseases of sheep, and indeed of other farm stock, caused by some members of a particular group of anaerobic germs labelled for purposes of classification the *Clostridia*. Unlike other classes of bacteria they are unable to propagate in the presence of free oxygen, that is, in the air as we breathe it. Thus it becomes necessary, when attempting to grow these germs in the laboratory, to ensure that they are cultured in an atmosphere rendered entirely free of oxygen. During their evolution it seems clear that some of the many *Clostridia* that exist in nature have undergone a process of adaptation to an animal environment. A few, in the course of their further development, have assumed a pathogenic role in relation to their host under certain special environmental conditions.

Reviewing the specific diseases that occur among our sheep one is struck by how many (e.g., lamb dysentery, pulpy kidney (enterotoxaemia), blackleg, braxy, black disease, to name but a few) are in fact caused by one or other members of this group of bacteria. Consequently some knowledge of the *Clostridia* is essential to an understanding of the diseases they can cause and their control.

Spore production

It would seem probable that the *Clostridia* are primarily soil organisms, in which environment they exist in a passive or dormant state, called a spore. The spore is highly resistant to external influences; indeed, in some cases spores can survive boiling in water for as long as 5 to 10 minutes. They are equally resistant to the effects of the majority of disinfectants and antiseptics, and also to weather conditions. For this reason it is possible for spores to remain alive in soil or dust for varying periods of time, probably years. They will enter the body of grazing animals on soil-contaminated herbage, and, moreover, spore-laden soil or dust may equally contaminate the outside of the animal body on skin, wool, hair, etc.

It is, therefore, not surprising to find herbivores, particularly sheep, to be most frequently affected by these particular diseases. Nor is it surprising to hear of certain localities, farms, or even individual fields referred to as braxy areas, lamb dysentery farms or blackleg fields, because of an associated history with these diseases. Animals grazing potentially dangerous pastures and having spores in or on their bodies themselves become sources of possible danger as carriers of one or other of these diseases when they are moved from their contaminated pastures to clean ones. Such animals cannot of course be identified. Thus ewes with lambs at foot moved from a lamb dysentery farm to a clean farm can, during the following 10 days or so, contaminate their clean environment with spore-laden droppings. Likewise a ewe harbouring the spores of black disease can be moved many miles and so contaminate the new environment. Whilst in their dormant or spore

state, the anaerobic bacteria remain innocuous, but for purposes of propagation they have to assume a vegetative stage in which they can multiply. During such multiplication some of the anaerobes produce water-soluble poisons, some of which are lethal, e.g., that causing botulism. But in order for this to happen it is essential that a suitable environment be present in their immediate neighbourhood, otherwise the organisms remain dormant and innocuous.

Nature of the diseases

The development of this suitable environment, therefore, becomes the deciding factor in the development of the disease by these anaerobes. This is the trigger that sets off the disease, and one is not surprised to find that it varies considerably from disease to disease. But although the nature of this trigger varies, it is always related in some way to general sheep management. One might rightly refer to these diseases then as "conditioned" diseases. An outstanding example of such a "conditioned" disease is pulpy kidney disease or enterotoxaemia. The particular anaerobe involved in this disease is known as *Cl.Welchii Type D* (lamb dysentery being caused by Cl.Welchii Type D). This organism is fairly widespread in the pasture soils of this and other countries throughout the world. Consequently it is frequently found as a "normal" inhabitant of the small bowel of many sheep. If, however, such sheep suffer from a temporary indigestion leading to an overspill of partially digested food from the stomach into the bowel, together with the impairment of bowel movement so caused, the essential environment is formed wherein *Cl.Welchii* (*Type D*) undergoes very rapid proliferation and produces lethal poisons in the process. If the latter is present in sufficient concentration the permeability of the bowel wall is increased, the poison is absorbed and death results.

The stomach and bowel are conditioned in much the same way to facilitate the toxin production of *Cl.Welchii* (*Type B*) to cause lamb dysentery. Here an over-generous milk supply by the ewe and a voracious appetite in her lamb provide the favourable environment in the lamb's bowel so that although born quite free of the infection, those germs which the lamb picks off the pasture or the soiled udder of the dam can proliferate so rapidly and produce toxin so abundantly that the lamb may die of the disease before it is twelve hours old.

Management, therefore, of a kind which involves a sudden change from a lower to a higher plane of nutrition, particularly in its protein content (e.g., spring grass, aftermath, concentrates) predisposes to those bowel conditions conducive to the development of pulpy kidney or enterotoxaemia. The same high protein diet is conducive to high milk yield, and so the tendency to lamb dysentery.

Another interesting example of "conditioning" is to be found in the development of black disease. This is caused by the anaerobe *Cl. Oedematiens*. The spores of this germ exist in certain soils in this and other countries and are, therefore, always a potential danger, if the right conditions are brought about. In black disease the grazing sheep takes in the spores of *Cl. Oedematiens* which are later carried by the blood-stream to the liver, among other places. They may remain alive and quite innocuous in this site for varying periods of time until the immediate environment is changed by

the activities of a meandering liver fluke bent on finding one or other of the numerous small bile-ducts. During its meandering the fluke destroys the fragile cells of the liver tissue, and in the process sets up the right conditions to activate the spores and facilitate their rapid proliferation and production of poison. This is absorbed into the blood stream, and if present in sufficient strength and quantity will prove fatal. Thus in practice we find black disease where liver flukes abound. This is not to say, however, that affected sheep may not have picked up their spores originally from land quite free from flukes. Thus the control of liver fluke disease helps to avoid black disease.

One last example of "conditioning" might be mentioned, as it is one which can be guarded against by routine procedures. Mention has been made of the possible contamination of the skin, hair or wool of animals by soil while at pasture or by the dust from a much used sheep-fold or shearing shed. Should such a contaminated skin be broken (a cut or scratch) during dipping, washing, shearing, docking or castration, by difficult lambing or *the injection of vaccines or sera*, the contaminated wound so caused is frequently the seat of operation for a very common anaerobe—*Cl. chauvoei*—the cause of blackleg. Blackleg as an operational hazard is a really serious factor and the need for care during such operations cannot be too strongly urged. Not infrequently more sheep die from such hazard as might have died from the disease the shepherd is hoping to prevent by his inoculations.

Prevention of diseases due to Clostridia

In the majority of cases the effects of the poison prove fatal, death frequently being sudden. In others, such as lockjaw, symptoms may last for some considerable time before death occurs. There is, therefore, little hope of treatment in such cases.

However, a thorough study of the poisons produced by these anaerobes has given information on two important points. It is known that each anaerobe in the group produces its own specific poison and that this can never be confused with the poison of any other member of the group. Thus *Cl. Welchii* (*Type D*) (Pulpy Kidney) produces a poison which can never be confused with that produced by *Cl. Oedematiens* (black disease) or *Cl. chauvoei* (blackleg). In fact, the members of the group owe their individual identification principally to the poison they produce. Secondly, and even more important, is the knowledge that these specific toxins are antigenic, i.e., they are capable of eliciting an immunological response in the host when present in sub-lethal amounts. Thus an animal infected with an anaerobe producing insufficient toxin to kill overcomes the toxin by itself producing the antidote—anti-toxin.

This basic knowledge forms the corner-stone of the method of specific preventive medicine in this particular context. Thus by subjecting susceptible animals to sub-lethal doses of specially prepared toxin (vaccine) an active immunity to that toxin can be produced within a short time which has a varying period of activity, but is seldom of less than six months' duration. Conversely, the immune animals' blood contains sufficient anti-toxin (serum) so that it, in turn, can be injected into a susceptible animal to give it immediate, but usually short-lived, protection against the specific toxin.

By the application of this knowledge, the use either of specific vaccine or of anti-serum, forms the scientific and practical approach to the control of these "anaerobic" diseases. Vaccine is employed exclusively as a long-term measure, taking time (about 10 to 14 days) to establish the immunity but being usually of long duration. Serum, on the other hand, is generally used to deal with cases of emergency where losses have already begun in the flock and an *immediate* protection is called for.

There are certain periods of the year when these diseases are most likely to occur. Whatever the disease may be, correct anticipation will favour the use of the appropriate vaccine. A plan of such preventive inoculations might, with advantage, be drawn up in consultation with a veterinary surgeon. But even if taken by surprise, recourse to the use of the immediately active anti-serum will serve to deal with the emergency.

The shepherd's part

In certain cases, and in particular with lamb dysentery since death can occur before the lamb is twelve hours old, the need must always be for the provision of an immunity in the lamb as soon as possible after it is born. This means that for two good reasons the shepherd has little alternative except to employ anti-serum. First, the immunity provided must be *immediate* if it is going to be of value. Second, animals as young as this have not the ability to respond to a vaccine to produce an active immunity.

Whilst the inoculation of lambs so soon after birth is a reasonable practice on lowland farms, it is almost an impossibility when ewes lamb down on the mountain. To meet this latter difficulty, it has been found possible to produce a strong, active immunity by vaccinating ewes in the autumn and again some two weeks before lambing is due to commence in the flock. This immunity is subsequently transferred to their lambs as they take their first milk. Such a procedure can also be used to prevent pulpy kidney in very young lambs.

Despite the widespread nature of the diseases caused by "anaerobes" and their natural persistence in their dormant phase in soil, their other attributes have permitted the scientist successfully to prevent these diseases, but this, only provided they are correctly anticipated by the farmer, both by avoiding some of the predisposing conditions in the management of his sheep and by the more specific preventive biological preparations that are available.

American Ducks

J. M. CULLINGTON,
National Agricultural Advisory Service

Mrs. Cullington visited Long Island, New York, this year and here gives her impressions of the duck industry in the United States compared with practice in Britain.

LONG ISLAND, close to New York, is the renowned centre of the American duck industry. As in England, the trade is confined mainly to hotels and restaurants, and is likewise in the hands of a comparatively small number of efficient producers. For the first time the entire output of the island, worth about 30m. dollars and comprising 7,500,000 birds, was this year the subject of a promotional sales campaign brought about by the formation of the Lond Island Duck Farmers Co-operative Inc. It is intended to cover radio, television, newspaper advertising, and direct approach to food editors and chain stores; and a survey is being made to pin-point potential buyers and aim publicity at this target.

The sole breed kept is the Pekin, which weighs about 7 lb at 8 weeks, with an eviscerated weight of just over 5 lb and a food conversion of 3·5-4·0. It is yellow fleshed, but akin to the Aylesbury in body conformation; as regards egg-laying, however, it falls more in line with the Pennine. Precise figures are difficult to obtain, but when I visited Long Island I was able to ascertain that on the largest duck enterprise 112 ducklings were produced per breeding duck in 1960; it was stressed that this was the best ever, for usually it is around 90.

Most of the farms are at the extreme tip of the island, virtually at the water's edge, and it is not uncommon to see a little of the Atlantic Ocean at the bottom of some of the pens. In most cases these pens are of almost pure sand and they lead down to a shallow concrete channel of fresh running water. All ducks have access to this, whether they are for fattening or breeding. The farms are highly specialized, a fact which seems to give a good deal of satisfaction to their owners, who are delighted to tell you that they produce no other stock or crops; ducks, and ducks only, are their interest and livelihood. The stocking rate is heavy; but this is offset by the fact that no farm operates, as in this country, for 52 weeks in the year. The resting period varies from 10 to 12 weeks and is usually arranged to coincide with the worst winter months. During this time all houses and equipment are cleaned and disinfected, and the runs are scraped and freshly sanded for the following season's birds.

Seemingly, there are many advantages in this system of gradual de-population; and when adequate freezing and storage facilities are available on our own duck establishments, a similar policy might very well be adopted, particularly if disease became a serious problem.

There is no home mixing of food. This is considered to be a job for the compounder rather than the producer. Two types of pellets are fed: 0-2 weeks $\frac{1}{8}$ in. and 2-8 weeks $\frac{3}{16}$ in. These sizes are considered important; so is the design of the hopper, which allows for easy shovelling in of the food.

Food wastage is a much considered point of management, and even during the early stages of brooding, each hopper is placed on a tray about 4 in. wider than the base so that anything spilt may be picked up again.

Some of the farms, as in Britain, do the whole operation from production of the hatching egg, to boxing and freezing of the finished product; others buy in at day-old and sell at eight weeks. Due to the wide variation in seasonal temperatures, much attention is paid to egg storage, and specially-designed holding rooms have been built to maintain a temperature of 55-60°F. On the whole, hatchability figures on the farms visited appeared to be higher than here; this might very well be due to the meticulous care taken before incubation.

Equipment on farm and packing station

Hot water pipes with oil-fired boilers appear to be the favourite brooding equipment, and in most cases the ducklings are kept on wire floors for the first three weeks. I was told wherever I went that this type of flooring is not suitable for a longer period, as the ducks develop sore and swollen feet. A distinctive feature of most of the brooding and rearing houses is a wooden platform over the hot water pipes, equipped with rails similar to a railway line, over which all food is transported to the house by truck. Delivery is quick; moreover the arrangement seems to be more fitting than a purely automatic feeding system.

One packing station, to be the keystone of the company recently formed to sell Long Island ducks, has an output of 50-60,000 per week, and the Co-operative Board of Directors is negotiating for ownership or control of the six existing processing plants and freezing facilities. The standard of hygiene is most impressive and, as in all units of this kind, each bird is examined on the eviscerating line by an inspector of the United States Department of Agriculture. Boxing is according to quality and weight, and birds are packed and presented in the most attractive manner. In addition, detailed cooking instructions are printed on the bag—a practice which we might well adopt, for it is surprising how few people know how to cook a bird of this kind.

Duck Research Laboratory trials

The Duck Research Laboratory at Eastport, a sub-station of Cornell University, deals only with duck problems and allied research, and is probably the only one of its kind in the world. The duck producers of the island contribute towards its expenses each year, and for this they obtain free post-mortems, vaccines, sera, and general advice and guidance. Much valuable work has been done under the directorship of Dr. Dougherty, who is held in high esteem by the growers. A breeding flock of 20 pens is kept; but no pedigree work is undertaken, and toe punching of the progeny to the sire is all that is done in the way of tracing relationship. Some of the trials taking place are on light intensity, and the possibility—by a system of family selection—of producing birds that will lay for a longer period.

Americans are concerned with the fat content of duck just as they are of all kinds of meat. In carcass composition the duck is similar to the pig; both need less protein for maximum weight gain. In other words, both these

species have a most efficient metabolism for the synthesis of fat. The Research Station has undertaken studies to determine whether it is possible to increase protein synthesis and decrease fat synthesis in ducks by increasing the protein content of the diet and/or by altering the metabolism of ducks through feeding thyro-protein. It was found that carcass fat could be reduced satisfactorily by feeding diets containing 1,250-1,300 calories of metabolizable energy per pound of food, if the protein level was increased to 22-26 per cent. Since it is known that 16 per cent of protein gives economic development, other means of reducing carcass fat were considered. Thyro-active material, in this case iodinated casein sold under the trade name of "Protamone", might have a beneficial effect on the carcass composition of ducks. "Protamone" was added at 50, 100, 150 or 200 grammes per ton. These experiments were carried out using a simple 16 per cent protein diet. The results have been published, and indicate that 50-150 gramme levels reduced the fat percentage and promoted an outstanding increase in growth. The treatments, which took place during the summer months, produced an interesting side effect—there was marked improvement in feathering. It was observed that full feathering occurred 3-4 days earlier than in ducks fed on the control diet, but whether a similar result could be obtained during colder periods is not known, since, unfortunately, a mechanical fault in food mixing stopped the trial.

The following recommendations published in 1960 were based mainly on experiments conducted at the Research Station with the aid of the Long Island Duck Growers Research Co-operative.

1. Repeated experiments have shown that satisfactory results can be obtained with upland ducks having no access to swimming water.

2. Food is better utilized when the energy value of the ration ranges from 800 to 1,250 calories of metabolizable energy per lb of food.

3. Rather than specify a definite amount of protein, it is better to have a balance between protein and energy, thus expressing the protein requirements as an energy/protein ratio:

Duck starter 0-2 weeks	70
Duck growers 2-8 weeks	78
Maintenance 8 weeks-maturity	72
Breeders	70

Twenty grammes of Niacin per ton (U.S. ton is 2,000 lb) will prevent bowlegs in ducks.

A 1,000 I.U. of commercially stabilized vitamin A per lb of diet is considered satisfactory, but when lucerne is used as the natural source 4,000 I.U. are required per lb of food. Broad or narrow spectrum antibiotics gave no improvement in growth or food conversion.

Disease

Work has been done on the disease side, particularly with virus hepatitis, and a serum (as opposed to the vaccine used here) is available at the onset of symptoms. This disease is not nearly as widespread as in Norfolk and it causes no undue concern. Cholera is very much present; mortality can be as high as 50 per cent. Bacterins made with chemically- or heat-killed culture of *pasteurella moltocida* is being used successfully at 1-2 ml, according to age. Sulphonamides have been applied (not before slaughter), but all flocks

do not respond favourably; and appetite is impaired whilst plucking seems to be more difficult. Cirrhosis of the liver has given high mortality in breeding stock, and it is thought that basically the cause may be nutritional, or that there may be an inherited tendency towards the disease.

Anatipestifer infection, known locally as New Duck Disease and in this country as Duck Septicaemia, is considered the biggest disease problem on Long Island. All farms have been affected and mortality can be high. Work has been done at Eastport, but no one has yet been able to isolate the causal organism. Sulphonamides have not given a good response; Terramycin, on the other hand, by injection does offer some help in alleviating the condition and preventing too heavy losses.

Comment and congratulation

My observations on the Long Island Duck industry are far from comprehensive, but I gained sufficient insight, I believe, to be able to make a fair comparison between it and the duck industry in this country, especially as I have worked for many years in a county which has produced 75 per cent of the national table duck output.

I had hoped to collect information on pedigree breeding and was very disappointed to find that work of this nature was not done anywhere on the island, even at the Research Station. And I was surprised at the rather naive approach to what would appear to be one of the most pressing problems there. It did not seem to be appreciated that undoubtedly a stage had been reached where future improvement could be achieved only by some programme of selective breeding. Admittedly, in Britain, too, little of this is done, but most of the larger breeders are at any rate fully conscious of the position.

I am not prepared to accept that to move ducklings five times during their short life is good management, or that swimming water is a necessity for the well-being of fattening ducks. Nor do I agree that mixing food is a job for the compounder only. In Norfolk the majority of the ducks are produced on general farms, so manure disposal has never caused concern, but the Long Island growers find it a ubiquitous problem, which is of course aggravated by the heavy concentration of stock in a relatively small area.

I envy the Long Islanders their organized marketing, their wonderful presentation of the finished product, and their efforts to make their fellow-countrymen conscious and desirous of what they have to sell. But most of all I envy them their Research Station at Eastport. It is no exaggeration to say that it is one of the focal points around which their industry revolves.

The English Farm Wagon

NIGEL HARVEY

The wagon was once the largest, most complicated and enduring piece of mobile equipment on the farm. Mr. Geraint Jenkins, formerly of the Museum of English Rural life at Reading and now at the Welsh Folk Museum, has recently published a detailed study of this masterpiece of the wheelwright's art.*

THE lordly four-wheeled wagon, with its team of horses, was once one of the traditional sights of the countryside, and it has appeared in countless pictures of haytime and harvest in the fields of Old England. Yet, historically, it was a quite recent addition to the farming scene and its operational career was short, some two centuries from beginning to end. Now it has passed into history along with the flail, the windmill and the horse-power on which it depended. Fortunately, however, it was granted its historian while its manufacture and use were still living memories, and enough wagons survived for systematic study. Mr. Jenkins has placed the future in his debt by a detailed and painstaking survey of nearly six hundred wagons of different types which he has traced with the aid of the Press, the N.F.U. and local societies. The findings of this survey form the basis of his book, which describes the evolution of the English farm wagon and records its different designs from its origins to its final departure from our farmlands.

Until the Agricultural Revolution of the later eighteenth century, Mr. Jenkins tells us that two-wheeled carts were the normal means of transport on the farm. But the new field system created by the enclosures, heavier crops and a general spirit of improvement combined to create a demand for some bigger and better means of carrying hay and corn from field to farmstead, from farmstead to market. So the village craftsmen applied themselves to meeting this need. Over much of the country, they took as their model the familiar carrier's wagon, which had been used for the haulage of goods since Tudor times, and so produced the "box wagon". In the south-west, however, they developed a four-wheeled wagon from the two-wheeled harvest cart of the region and so produced the "bow wagon". Thus arose the two main types of the largest, most complicated and most enduring piece of mobile equipment used in farming before the coming of the internal combustion engine.

Agricultural need created the wagon: agricultural need determined its distribution. For, in general, wagons were confined to the corn-growing areas of lowland Britain. They were uncommon in such grassland districts as the Cheshire Plain and in the uplands of the west, almost unknown in northern England, mountainous Wales and Scotland. In hilly and pastoral districts the cart continued unchallenged by its new rival.

Agricultural need also controlled the design of the wagon, for there was considerable variation from area to area. Sometimes the old ideas persisted. Thus in southern Shropshire agricultural wagons closely followed the design

*_The English Farm Wagon._ J. Geraint Jenkins. A Museum of English Rural Life published by the Oakwood Press for the University of Reading. Price 42_s_.

of the road wagons, though these heavy, broadwheeled vehicles were poorly suited to the hilly terrain they were required to serve. But usually local type reflected local circumstances. In East Anglia, for example, wagons were large and boxlike, in the Cotswolds they were lighter and more manoeuvrable. Similarly, wagons designed for the Sussex clay country were fitted with broad wheels, those for downland chalk with narrow ones. Incidentally, Constable's famous *Hay Wain* can be identified as a type of wagon used in such wooded areas as West Sussex; the body was removable, so that the undercarriage could be used for carting timber. Constable, a miller's son, had seen a good many wagons in his time, and his hay wain was as real and precise as its landscape setting.

This local differentiation is one of the major themes of the book. Mr. Jenkins has found it possible to describe for the first time the characteristics of nearly thirty distinct regional types of farm wagon and to define the areas in which they were built and used. There they all are, Eastern and South-Western wagons, East and West Midland wagons, Wessex and Lower Severn Basin wagons and all their geographical-cum-technical relatives, divided and sub-divided into their various classifications as meticulously as the cultures catalogued by Toynbee. The details of the various designs—"The South Midland wagon is equipped with a roller scotch and drag shoe but never with a dog stick"—are mainly for the more dedicated type of specialist. But the general impression is clear. Each design was the product of local experience, which gradually hardened into local tradition.

Nevertheless, the regional differences thus developed were no more than variations on a central constructional theme. The general principles of wagon-building were the same throughout the country, and Mr. Jenkins devotes a substantial section of his book to the wheelwright's craft, "one of the most complicated of all woodcrafts". In great detail he describes the making of the various parts of the wagon, the wheels, the undercarriage, the shafts, the body and the brakes, from the choice of timber to the final stage of completion. His account of the methods and tools used is admirable. But it is the wagons themselves which give the true measure of their builders' patient and diligent skill. For consider the stresses and strains suffered by these huge vehicles as they lurched over uneven fields and along rutted lanes loaded with anything up to four tons of hay or corn. Remember that many of the wagons studied by Mr. Jenkins had endured fifty, seventy, a hundred years of such treatment—one, indeed, was in use every year from 1838 to 1951 and is still in a perfect state of preservation. And marvel at the flexible strength of their construction. The old wheelwrights built their wagons to an exacting standard for an exacting job and they built them to last.

Indeed, their products outlived them. For in the later nineteenth century the traditional wagon of local type was gradually replaced by the multi-purpose Scotch cart, which became increasingly popular in this period and by the standardized designs of the large-scale manufacturers whose systems of construction enabled them to undersell the village craftsmen. A few country wheelwrights survived, but they too adopted simplified designs and cheaper methods of construction, so that even in isolated districts the manufacture of bow wagons and box wagons had ceased by the outbreak of the First World War. It was significant of the change that whereas the older

wagons were boarded with ash, poplar or elm, their successors were boarded with deal planks. The age of local materials, as of local skills, was over. And soon the centralized factory-system was to produce power and equipment of unprecedented type which banished wagon and cart alike from the fields.

Mr. Jenkins has added significantly to our knowledge and understanding of the rural past, and his massive, scholarly and meticulous study will unquestionably become the standard book on the subject. For the general reader, however, it will probably remain a work of reference. The theme is specialized and the argument highly detailed; the fusion of general history with the report of a particular survey has caused difficulties of presentation; and in the early chapters Mr. Jenkins, the enthusiast, has triumphed over Mr. Jenkins, the editor, by including an excess of interesting but irrelevant information on the remoter regions of the English farm wagon's more distant ancestors. This would surely have been more suitable in a separate publication. Nevertheless, if you want any information on these masterpieces of the wheelwright's art, this is the book you should consult. And if you want to see examples, you will find in it an appendix cataloguing some forty farm wagons now preserved in museums in this country; though, incidentally, should not the Sussex wagon at Michelham Priory, near Hailsham, be added to this list?

The book is beautifully produced, thoroughly referenced and admirably illustrated with more than fifty photographs, drawings and plans. Inevitably, it is expensive. But with history, as with anything else, you must expect to pay for quality.

Farming Cameo: Series 2

43. Rutland

GEOFFREY R. CLOSE

General Agricultural Advisory Officer

IT has been said that "Rutland is a bit of England as she was before the Industrial Revolution". The total size of the county is only 97,000 acres, of which no less than 84,000 acres are agricultural land. The 13,000 acres not in agricultural use include two aerodromes, woodlands, mineral undertakings and built-up areas, as well as the two small towns of Oakham and Uppingham. The population of the county is only about 24,000—just over 2,000 more than it was in 1861. The average size of full-time farms is 197 acres, and these are usually worked on a simple mixed arable system. Rutland lies higher than much of Lincolnshire to the north and east and is, therefore, exposed to the north-east winds, so that spring comes late. The annual rainfall averages about 24 inches. Barley is the most important single crop, followed by wheat, with potatoes, sugar beet and kale forming the rootbreak. Grass, both permanent and temporary, occupies about half the total acreage—a proportion that has remained remarkably steady over the last few years—and is grazed by sheep and beef cattle. Dairying is not an important feature and neither, except on a few farms, are pigs and poultry.

A glance at a soil map of Rutland emphasizes the extreme variation in soil types which occurs throughout the county. This variation is still further complicated by numerous geological "faults", which mean that it is quite common to get as many as three different soils in the same field. Broadly speaking, however, the western side of the county, which the Land Utilization Survey of 1935 described as the "ridge and vale" region, is a clay area, the ridges being capped with Northampton Sand and the valleys being lias clay. The arable land used to be confined to the tops of the ridges but now the whole area is farmed more or less on a ley system. Many farms here are worked on a simple rotation of three years arable—mainly cereals—followed by three years ley, a rotation which fits in very well with the cattle and sheep policy. Acidity problems arise on the lower slopes due to ironstone water which emerges as springs at points where the Northampton sand and Upper Lias Clay strata meet. These springs, unfortunately, do not always occur in the same place each year but a system of intercepter drains followed by dressings of lime usually provides the answer.

On this western side livestock rearing is the traditional farming enterprise, although on the better land bordering the Welland big cattle are still fattened for the Midland markets. In the last twenty years much of this land has also been ploughed and is now successfully farmed on an arable rotation. Cattle feeding, as opposed to rearing, however, has now spread with ley farming to all parts of Rutland, even to the heavy boulder clays. Cattle are usually bought in, either as calves in local markets or further afield, or as stores from the North. Herefords and Friesians, and their crosses have now

largely replaced the traditional Lincoln Reds. They are fed in yards on arable by-products in the winter, silage being increasingly used.

On the east side of the county there is a mixture of lighter soils, chiefly Inferior Oolite, which have been farmed for a very long time on a traditional sheep and barley system. This land produces excellent malting barley, also sugar beet and potatoes as the main cash crops, while sheep are kept in very large numbers. The sheep population of Rutland is by far the densest in the East Midlands, there being nearly 70,000 sheep on the 84,000 acres of agricultural land. The sheep tend to follow the soil types, with Scotch Half-bred and Suffolk Scotch Half-bred ewes predominating on the lighter soils and Masham and Greyface on the clays. Down rams are used. The trend is now for farmers to increase the ewe flock rather than winter many of the lambs. These are sold fat off their mothers. Sheep have had a long history in the county. There is a record of a farming family at Exton whose forebears exported wool to the Continent from the port of King's Lynn in Tudor times. The many elegant churches built with the native limestone bear witness to the profitability of wool in the past. In areas where there is sufficient water, irrigation of such crops as early potatoes and sugar beet is being introduced. Horticulture is confined mainly to the gardens of private estates which have been commercialized, though an acreage of black currants has recently been planted on a few farms.

There are few major industries in Rutland, but who has not heard of Ketton cement? Clipsham stone, too, is world famous for its ability to stand up to adverse conditions. This, together with its very near neighbour Collyweston stone slates, is still used for most of the colleges at Oxford and Cambridge, and special blocks of stone are marked annually at Clipsham Quarry for use in repairs to the Houses of Parliament. Ironstone winning is the major outside activity affecting agriculture. The problem of restoration is becoming very difficult now that very large machinery is being used to extract ironstone from depths of up to 90 feet by opencast methods. New problems may arise in future, owing to underground ironstone mining —a new technique. At present no obvious signs of this are visible from above, but no one knows what the ultimate effect will be when the remaining pillars of ironstone are removed.

Rutland is a county rich in history and traditions (one of which is the famous Cottesmore Hunt) and whatever the result of the proposed boundary alterations, it will remain well farmed, neat and picturesque, with its gently rolling countryside and mellow stone buildings.

Your Fixed Equipment

Reclamation of Derelict Woodland by the Landlord

G. D. NIGHTINGALE,
Agricultural Land Service, Lewes

THREE courses lie open to a landlord who owns derelict woodland near or adjoining some of his tenanted agricultural land. He can leave it alone, replant it (perhaps with financial assistance from the Forestry Commission) or he can convert it to farm land, so adding to whichever of his holdings will most greatly benefit by an increase in cultivable land. Assuming the latter, there are, however, a number of physical features calling for consideration to weigh the benefits likely to accrue from such conversion, and the maximum expenditure which can safely be made. These are the nature and density of the existing undergrowth and the age, size and number of tree stools, all of which must be recorded in detail. If the land is not uniform in most of these respects, it should be divided into suitable blocks on the plan so that the specification of, and the tenders for, the work to be done may relate to different methods for each block as necessary. The landlord will naturally choose the best season, organizing the work to take full advantage of good weather, and employment of a reliable and experienced firm will ensure that the conversion to bare ploughable land is made in one unbroken operation. Next, he will consider whether the new land needs ditches, drains and permanent fences, and at the same time he will consider the quality and depth of the top soil.

The situation of the converted land in relation to the farm to which it will be added, or to the homestead, will greatly affect its usefulness to the tenant. The cost and effect of the conversion must therefore be studied carefully in relation to the farm. If the area of new land is appreciable, its effect on the present fixed equipment of the farm should be carefully considered and an estimate made of the cost of additional buildings likely to be asked for by the tenant.

The tenders will show the landlord the likely cost of converting derelict woodland to land suitable for agriculture. In the meantime he can think about the increased rental value of the farm with the new land added.

When the tenders are received he can assess the capital cost of the reclamation. This account will include not only the cost of reclamation but also an allowance for ditching, draining and fencing. After allowing for any grants which he may obtain he can judge whether the anticipated increased rent shows an acceptable return on the net expenditure. If it does, he will then be able to negotiate with his tenant the terms upon which the reclaimed land is to be added to the farm.

Although the method of reclamation will depend upon the physical condition of the woodland, and to some extent upon the time of year when the work is done, some general hints can be given.

If underground drainage is to be done, then there must be the least possible interference with the subsoil. In such cases blasting to remove tree roots may be impracticable and bulldozing the only way. And if the land is to be put away to pasture, then trees may be left at suitable places to provide shelter for it. Indiscriminate burning may destroy valuable fencing materials; the owner will be wise to bear this in mind.

Experience has proved the wisdom of methodical working. The owner should insist upon progressive clearance burning. This is particularly important where the area is substantial, because cultivation can begin earlier and follow up the reclamation. In this way some of the land may be brought into use earlier, to the owner's benefit.

Landowners and farmers contemplating reclamation of land can get advice from the Agricultural Land Service.

THE MINISTRY'S PUBLICATIONS

Since the list published in the October, 1961, issue of *Agriculture* (p. 363), the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 5d.).

ADVISORY LEAFLETS

No. 320. Poultry Manure (Revised)

No. 406. Dahlias (Revised).

FARM MACHINERY LEAFLET

No. 22. Food Mixers (Revised)

OTHER PUBLICATIONS

Experimental Husbandry Farms and Experimental Horticulture Stations Progress Report 1961 (New), 4*s*. (by post 4*s*. 5*d*.)
The second Annual Report on work of the experimental centres of the National Agricultural Advisory Service.

The Accelerated Freeze-drying Method of Food Preservation. (New.) 12*s*. 6*d*. (by post 13*s*. 5*d*.)
An illustrated and detailed report on the method of food dehydration termed accelerated freeze-drying (AFD) devised by the Ministry's Research and Experimental Factory at Aberdeen.

Manual of Nutrition. (Revised.) 3*s*. (by post 3*s*. 4*d*.)
Gives detailed explanation of the properties and sources of the nutrients which are essential to healthy growth and maintenance of the body.

Report of the Committee on Sheep Recording and Progeny Testing. 2*s*. 6*d*. (by post 2*s*. 10*d*.)
Sets out the conclusions of the Committee, under the Chairmanship of Mr. Ivor Morris, J.P., which has studied the practical aspects of recording and progeny testing.

At the Farmers' Club

Irrigation, and the Disposal of Farm Sewage

MR. J. S. MORREY and MR. MAITLAND MACKIE shared the platform at the Farmers' Club on 11th October, when the subject for discussion was irrigation, both with plain water and as a means of disposing of farm sewage.

Mr. Morrey frankly admitted that he could not say how many more gallons of milk he sold in a dry year as a result of irrigation—"I am a farmer, not a research worker"—but nevertheless he hoped his paper would clarify the circumstances in which irrigation could make a useful contribution to a livestock farmer's economy. "If the emphasis is on grass quality", he said, "irrigation will go a long way to iron out the exaggerated growth curve in seasons of low rainfall . . . the more intensive the grass production programme, the more attractive irrigation becomes, for the available moisture is usually the limiting factor. A lot of nitrogen applied in expectation of rain may never be harnessed in a dry year".

Mr. Morrey did not agree that buying cake to bridge a dry spell is cheaper than investing in irrigation equipment. "In my experience", he said, " I have never obtained the response from my cows by substituting cake for high quality grass as a summer food for milk production." Irrigation has a useful part to play where grass production is above average, and the constant need for high quality grass is critical, as with a spring-calved herd, with cows in full milk during the summer. With the help of irrigation, a constant supply of nutritious grass can confidently be arranged right through the growing season—"the whole programme of grass growth and utilization becomes a made-to-measure calculation."

Plant must be chosen carefully so that its mode of operation can be integrated with that of the farm as a whole. Key factors governing the type of equipment employed include the available water supply and its proximity to the area to be irrigated; the crops which properly come under the heading of "critical need"; and the available labour to operate the system. A tractor-powered portable unit is attractive for a long river frontage. The construction of dams or boreholes requires expert advice. Electrical operation, using time switches, may be simpler and cheaper. A permanent underground main qualifies for a Government grant, and also saves labour.

Mr. Morrey's Wiltshire farm, on greensand with an average rainfall of 34 inches, is heavily stocked: 400 acres of grassland and 70 of barley provide 90 per cent of the food for 550 ewes and lambs and 390 cattle, of which 200 are dairy cows, averaging over 900 gallons of milk. Starting in 1955 with two rain guns operating from two streams, in 1960 Mr. Morrey added a borehole yielding 11,000 gallons per hour, which, plus a stream from which 8,000 gallons per hour are taken, can now provide an inch of water on 2½ acres in 3 hours, via a 6-inch main and two sets of sprinklers, operated automatically by a 30-h.p. electrical pump. The net cost of this outfit, after grant, was £3,100. It serves 100-120 acres and covers the dairy cows' grazing

requirements. In practice Mr. Morrey goes further, using both outfits to restore each field to field capacity as soon as possible after sward removal, to germinate seeds quickly, and to wash in fertilizer. Up to 5th August this year it has put about 9 inches of water on 180 acres to redress an estimated deficit of 7 inches. The cost of irrigation during the seven summer months of 1961 totalled £700, including overheads. Milk production was 57,000 gallons from 85 cows grazing 50 acres of irrigated grass to which £600 of fertilizer had been applied. The alternative expenditure on £700 worth of dairy cake might have produced 14,000 gallons of milk towards the estimated 25,000 gallon deficit caused by drought.

Disposal of farm sewage by organic irrigation has been in operation for eighteen months at Mr. Maitland Mackie's 750 acre Aberdeenshire farm, where there are over 400 dairy beasts including 150 milking cows, 300 pigs, 4,000 laying hens in cages and 18,000 broilers. Rather more than half the farm is in grass, the rest in grain. Although Mr. Mackie considered that ordinary irrigation would not be economic there (the rainfall of 31 inches is fairly evenly spread throughout the summer), as a system of disposing of some of the 2,000 tons annual accumulation of muck, organic irrigation seemed worth considering. This was particularly so, as by adopting slatted floors for the young cattle, and for the cows in front of their troughs, a lot of straw could be saved. Below the slats a channel with a water sluice at the end leads the manure through a 12-inch drain into a 45,000 gallon tank, equipped with an agitator to keep the solids in suspension while pumping takes place. The contents of the tank are transferred to the land by a Buchner piston pump via 1,000 yards of 4-inch aluminium piping and two rain guns. This Farrow system plant cost £2,000; £4,000 was spent on drains and alterations to buildings, the cost being offset by a grant of £1,300. Annual savings are estimated at about £1,400 for litter, £240 for tractor and labour costs plus about £100 for increased carrying capacity of the buildings. Including the nitrogen value of the manure, Mr. Maitland Mackie put the total yield on the investment at around £2,000, and he has already obtained beneficial results.

Plans for further improvement include installing an extra section to the tank, to hold clean water for washing out the slats and the area used by zero grazing cows (this is more congenial than using the liquid manure), and the installation of underground mains and standpipes. The early misfortune of burst pipes made the system unpopular with the staff—"the stuff has an appalling stench"—but protective clothing and greater care have made operations less unpleasant.

Mr. Maitland Mackie emphasized that large storage tanks are essential for holding the manure in a liquid state during the time when application would be wasteful. Forecasting a great increase in slatted floors for housing pigs and cattle, he declared that of all the methods of dealing with the resultant manure, the organic irrigation pump is certainly the best, although the most expensive to install. "I am convinced", he added, "that it will return a good yield on capital, and will be used increasingly in this country to the benefit of all concerned".

SYLVIA LAVERTON

Agricultural Chemicals Approval Scheme

Additions to the 1961 List of Approved Products

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The first list of Approved Products was published on 1st February, 1961.

INSECTICIDES

MORPHOTHION-LIQUID FORMULATIONS

Systicide—Pan Britannica Industries, Ltd.

PYRETHRUM WITH DERRIS

Synergised pyrethrins with rotenone for the control of aphids, caterpillars, red spider mite and thrips on a variety of outdoor and indoor flowers and vegetables by the amateur.

Aerosol Dispensers—Cooper's Garden Spray—Cooper, McDougall & Robertson, Ltd.

FUNGICIDES

SULPHUR—COLLOIDAL AND WETTABLE FORMULATIONS

Electrosulph—Mi-Dox Agricultural Division of Rentokil Products, Ltd.

ZINEB—WETTABLE POWDERS

Vitrospor-PB—Vitax, Ltd.

HERBICIDES

DALAPON—SODIUM SALT SPRAYS

Profarma Dalapon—Profarma Ltd.

MCPA—POTASSIUM AND SODIUM SALT FORMULATIONS

Boots MCPA 25—Boots Pure Drug Co. Ltd.

MCPB WITH MCPA—POTASSIUM AND SODIUM SALT FORMULATIONS

Trifolex-tra—Shell Chemical Co. Ltd.

MECOPROP—POTASSIUM AND SODIUM SALT FORMULATIONS

Dukes CMPP—James Duke & Sons, Ltd.

PENTACHLOROPHENOL (PCP)

A contact pre-emergence herbicide for control of annual weeds in root crops such as sugar beet, carrots and onions; bulbs; and certain vegetables. Also used as a desiccant on clover or lucerne crops for seed.

Liquid Formulations

Fisons PCP—Fisons Pest Control, Ltd.

Sprex—Shell Chemical Co., Ltd.

SEED DRESSINGS

ORGANO-MERCURY—LIQUID SEED DRESSINGS

Aabiton—F. W. Berk & Co., Ltd.

MISCELLANEOUS

METALDEHYDE—DRY SLUG BAITS

P.B.I. Slug Pellets—Pan Britannica Industries, Ltd.

Reminder: Seed Dressings and Risks to Wild Life

Dressings containing dieldrin, aldrin and heptachlor can kill birds that eat treated seed. Great care should be taken not to leave any treated seed lying about when it is being stored or sown. Higher strength dressings for wheat bulb fly should be used only on winter wheat and then only in areas where there is a real danger of attack. Dressings containing dieldrin, aldrin and heptachlor are not to be used at all for spring sown grain.

In Brief

DRAINING YOUR FARM BUILDINGS

You ought to know about some new laws that may affect your farm drainage. The Public Health Act, 1961, deals with buildings which drain into public sewers. Farm effluent is now to be classed as "trade effluent", and it will be necessary to satisfy the local Sewerage Authority about the amount and quality of farm effluent before it will be accepted. Farm effluent includes waste products like liquid and solid manure and water that has been used for washing down dairies, cowsheds and so on. These arrangements do not apply to domestic sewage or to the run-off from the farmhouse, etc. A farmer whose drains are already connected to a main drainage system need have no fear so long as the quantity or nature of the effluent does not change very much.

The provisions of the Rivers (Prevention of Pollution) Act, 1961, on the other hand, are likely to affect a greater number of farmers. This Act requires that no discharge from farms, industrial concerns or residences shall be passed into a river, stream or watercourse without the consent of the appropriate River Board.

So, if the effluent from your farm discharges into a main drainage system, it will be the concern of your local Sewerage Authority (normally your Local Authority); if it discharges into a watercourse it will be the appropriate River Board. At the same time you may like to know that you can appeal to the Minister of Housing and Local Government against any decision the Sewerage Authority or River Board makes under these Acts.

Effluent from livestock is stronger and more difficult to treat than the human variety. Plant to deal with it could be costly to build, expensive to run and unreliable in cases of high concentration. The practical solution seems to lie in making use of the effluent by distributing it on the land, either through pipes over or under the ground, or in solid form mixed with straw or similar bulky material which absorbs the liquid element.

In the case of a covered yard, where no piped drainage is necessary, the simplest way of collecting manure is by mixing it with straw. But with paved areas, open to the weather, rainwater running into the drains aggravates the problem of disposal by increasing the quantity of liquid.

In buildings with slatted floors, manure can either be mixed with water and discharged into tanks or scraped out in a semi-solid condition for carting out to the land. But whichever method is adopted, space is needed for storage of the manure below the slatted floors of the buildings.

Experiments have been made recently with systems of over-ground spraying, where diluted effluent is mixed in tanks by means of agitators and spread over the land through large-bore perforated pipes. The capacity and cost of the storage tanks necessary will depend on the required frequency of application.

When new buildings or extensions to existing ones are planned necessitating the piped disposal of manure or any effluent, the Sewerage Authority should be consulted before any work is begun.

F. W. Holder

LETTUCE AND TOMATOES IN DUTCH LIGHT HOUSES

Lettuce in unheated Dutch light structures used to be regarded as the profitable crop, with tomatoes not much more than something to occupy the houses during the summer and just about paying their way. At Stockbridge and other Experimental Horticulture Stations they have been looking at the possibility of increasing the value of the tomato crop without impairing that of lettuce, and indeed, of trying to get a better return on lettuce as well.

Their experiments showed that there was nothing to be gained by spacing the lettuces at distances greater than 8 in. × 8 in.; nor that the normal commercial spacing of tomatoes at about 13,500 plants to the acre could be improved on. But they did find that early planting of tomatoes had "a profound effect in increasing total yield and a much greater effect on the proportion of the crop harvested in the first month of picking, when the returns for cold house tomatoes could be expected to be at their highest level".

This, of course, involved clearing the lettuce earlier, which in turn indicated the need for promoting earlier maturity in lettuce. As expected, early planting gave a proportionately small but nevertheless real advantage in earliness of maturity, the pre-Christmas plantings being approximately a week earlier than those made after Christmas.

The most startling effect of early planting, however, was the reduction in losses from *Botrytis*, and it was clearly shown that plants left undisturbed in the seedbed until the turn of the year had become predisposed to attack by this disease. A still greater hastening of maturity resulted from the introduction of the early variety May Princess, which matures about 10 days earlier than the standard variety May Queen. The search for still earlier varieties is continuing and plant breeders are at work on improved varieties. The performance of May Princess has shown that size is not necessarily lost with earliness.

The full story of this and other experimentation at the Ministry's Experimental Horticulture Stations and Husbandry Farms will be found in the 1961 Progress Report (4*s*. from H.M. Stationery Office or through any bookseller).

FIRES IN FARM BUILDINGS

A farm fire is a disaster. If you've seen one you'll have no doubt; if you've experienced one you'll not want another, for no visitation is more unwelcome or devastating.

There are far more fires on farms than are generally known about. In 1959 there were 2,980 fires in farm buildings in England and Wales attended by local authority fire brigades. Among trade premises, only retail shops exceeded this figure, and then only by 44. It is a sobering thought that fires in farm buildings were ten times more frequent than in such trades as textiles, wood working, furniture and paper-making. Is the reason for this sheer carelessness?

The main causes of farm fires were incubators and brooders, children playing with matches, burning rubbish, and cigarettes and tobacco. The cause was unknown in 836 cases. What went wrong with incubators and brooders to cause 424 fires? Where did the children who caused 364 fires get the matches? How stupid of smokers to cause 252 fires! Adults ought to know better—or were they all school-boys? And what really happened in those cases—more than two every day—where the cause was unknown?

After the causes we should look at the materials which first caught alight. Hay and straw are top of the list. Of 1,724 reported cases in agriculture and forestry, 612 involved hay or straw in stacks and 768 loose hay or straw. Grass, heather and bracken accounted for 260 cases of fires in buildings.

From these facts and figures there is an obvious lesson—take extra care when using anything which may cause a fire. Don't fill the brooder lamp with oil without first putting out the flame. See that the wick is not set higher than it ought to be, and that there are no draughts to draw it up. Above all, go back ten minutes after re-lighting or after adjusting the wick and check that everything is safe. If you can help it, do not smoke about the buildings. If you must smoke, watch what you are doing with matches and cigarette ends, and try to keep matches and children well apart.

If you look around, you're sure to see old sacks, heaps of old hay and straw, bundles of baler string, oily rags, and other materials which could cause a fire

that might destroy your buildings. Clear them out, and see no more gather in their place.

Encourage your workers to be safety-conscious. Tell them about these facts and figures. Tell your children too. Most fires start because of neglect or carelessness. Take care, and you will avoid the catastrophe—and it is a catastrophe—of a fire. Just ask yourself this; what will *you* do if your buildings are burned down this winter?

C. Robinson

FOOT-AND-MOUTH DISEASE

In his Report for the five years 1956-60, Dr. Ian Galloway, Director of the Animal Virus Diseases Research Institute at Pirbright, emphasizes that the programme of the Institute must be seen in relation to foot-and-mouth disease in this country and, in turn, as a world problem. In Britain, periods of relative freedom from the disease (or at least of low incidence) are interrupted by times when as many as 200 farms may become infected in one month. These periods of higher incidence do not generally last more than three or four months and the number of animals involved in relation to the animal population of the country remains at less than half of 1 per cent. It is generally agreed by authorities on this subject that a vaccination programme against the disease in a country where it is endemic is unlikely to reduce the incidence much below this figure. If, therefore, the disease were allowed to become endemic in Britain and vaccination were decided upon, the ultimate goal which could reasonably be achieved would be an incidence equivalent to that which now obtains. At that point, a slaughter policy would undoubtedly be invoked to attempt to achieve eradication of the disease.

If the situation in the European countries is considered, it will be seen that, in spite of an increasing extension of vaccination since the 1951-52 epidemic, the incidence of the disease, although greatly reduced, is still somewhat higher than in Britain. Some countries are applying and others considering limited slaughter of infected animals as a further step towards eradicating the disease. Outside Europe, in endemic areas, effective control of the disease is still some way off, and it is here perhaps that new improved vaccines have the greatest role to play, in the cost of a vaccination campaign can be reduced and the efficiency of the vaccine increased. Assistance in reduction of the incidence of the disease elsewhere than in Britain is at present the greatest contribution that can be made towards the control of the disease within the country.

The Report is available from the Institute, price 2*s.* 6*d.*

WORLD PLOUGHING CHAMPIONSHIP

William Dixon, aged 29, of Brampton, Ontario, won the World Ploughing Championship at Grignon, near Paris, last month. He has been competing in ploughing matches since he was 16 years old. In 1959 he was the Ontario Champion and in 1960 won the Canadian Championship.

RETIREMENT OF MR. C. E. HUDSON

Mr. C. E. Hudson, C.B.E., V.M.H., N.D.H., the Ministry's Senior Advisory Officer (Horticulture) since 1st May, 1948, retired from the public service on 17th November, 1961. Mr. P. H. Brown, N.D.H., has been appointed as his successor.

Book Reviews

Vegetable Diseases and their Control. C. CHUPP and A. F. SHERF. Constable, 84*s*.

There are now several books for those wanting to learn how to recognize and control the many fungus, bacterial and virus diseases of vegetables. This one, by two well-known plant pathologists from Cornell University, sets out to help both the grower and advanced student. The very readable style in which it is written should immediately appeal to both. Also the authors' approach is essentially practical, both with the cultural guidance for the grower, and the scientific information for the student for whom sufficient details are given where it is necessary for the correct identification of the casual organism. Selected references, nearly all of which are to general literature, are given for anyone wishing to go further into the scientific aspects.

The authors have covered most of the important vegetable diseases, whether they occur in America or not, but inevitably there is a strong bias towards American experience. The first two chapters are of a general character. One covers seedling diseases caused by soil-borne pathogens and the emphasis on protective seed treatment shows how much more widely this is practised in the U.S.A. than it is here. The second deals with about sixteen diseases which attack a wide range of vegetables: about half of these do not occur in this country. Several of them attack potatoes and references are made to this crop here but for the rest potato diseases are left for another book!

The main part of the book, occupying some 500 pages, deals in detail with the diseases of the individual crops, which are arranged alphabetically. For each disease there is a short historical introduction, a description of the symptoms (often illustrated by a photograph) and, where appropriate, the life history and description of the pathogen. A unique feature is the inclusion of temperature ranges for most of the pathogens. To finish there are three more general chapters on nematodes, minor element deficiencies and soil sterilization.

The book is undoubtedly a useful contribution to the literature on vegetable diseases but is probably of rather limited appeal in this country. *F.J.M.*

Soil Conditions and Plant Growth: SIR E. JOHN RUSSELL. Longmans, Green. 63*s*.

It is now nearly fifty years since Dr. E. J. Russell, then newly appointed Director of the Rothamsted Experimental Station, wrote a small volume of some 168 pages under the above title. Its purpose was to make an orderly and critical survey of the large but still manageable volume of scientific writings about the soil as a medium of plant life. This remarkable book did a great service for research workers, teachers and students of soil science, for in its pages they could take a look at their subject in one piece and see the numerous gaps that needed filling. The price of this admirable review of a rapidly expanding subject was the need for frequent revisions to keep pace with new ideas. Sir John Russell saw the book through seven editions and, on his retirement in 1943, handed the responsibility for future editions to his son, Dr. E. W. Russell, whose complete revision appeared in 1950. In the present (ninth) edition, Dr. E. W. Russell has thoroughly revised most of the sections in twenty-three of the chapters. Hundreds of references to papers published in the last eleven years give some idea of the task of selection involved.

Besides the many additions relating to recent theoretical advances in soil science, several of the new sections come closer to practical affairs of soil management: the activity of earthworms and, in the tropics, of ants and termites; breakdown of toxic substances in the soil as affecting the persistence of weed-killers; the release of fertility following the heating and drying out of the soil; and bacterial fertilizers—to mention only a few. The treatment of nitrification and the biological fixation of nitrogen is brought up to date and much enlarged; and the chapter on soil phosphate and the reactions and behaviour of phosphatic fertilizers has been completely rewritten in the light of recent work.

It may be that the book cannot claim a place in the "desert island" library, but for soil scientists on island or mainland it should be found very high in the list.

H.V.G.

The Evolution of Agricultural Co-operation. LOUIS P. E. SMITH. Basil Blackwell. 25*s*.

This is not a chronological account of the emergence and development of agricultural co-operatives. It examines the many forms which agricultural co-operation has taken, and describes the functional growth of the co-operative from its rudiments to the elaborate and highly centralized forms on a national or international level. But it also considers the nature of the relationships and problems which arise as the co-operative in its various forms comes into contact with other social and economic groups and eventually the state itself.

The book is divided into three sections. The first is concerned with the work of the co-operatives in processing and marketing, purchasing and supplying credit. It considers the forms in which co-operation has appeared on the farm itself, and the factors which tend to promote it. Special attention is given to the problems associated with the central organization of co-operatives.

In the second part, the author discusses the place and integration of the farm co-operative within the state; its relations with other social and economic groups, and with other business sectors and the state. The special role which education has played in the co-operative movement is examined.

The third part re-appraises the social and economic aims of co-operation, and discusses co-operative thinking on capital and entrepreneurship. There is also an interesting chapter on co-operation, even monopolistic co-operation, as an alternative to either private or state monopoly.

Of the three sections, the first is the least satisfactory, since it comprises a rather indigestible mass of often sketchily presented examples, drawn from a wide variety of countries and varying points in time. The two later sections are far more readable. Some of the arguments presented tend to lack development, but this is perhaps unavoidable in view of the ground which Dr. Smith attempts to cover in some 200 pages. Despite these shortcomings the book contains much material of very great interest and is of undoubted value in its coverage of less familiar aspects of co-operation. Moreover, it successfully conveys two important impressions: first, that of the important position already attained by co-operatives in the social structure of many countries; and second, the very great diversity of form which co-operatives may take.

S.T.M.

The Economics of Hill Farming. E. A. ATTWOOD and H. G. EVANS. University of Wales Press. 21*s*.

Economic return is the crux of the hill farming problem, and the results of this well-planned survey of 200 such farms in Wales show the reasons for low profits; on many, the output was insufficient to cover the inescapable overheads of labour, rent, machinery and sundries, which were over £1,000 even on those in small acreage groups.

Of those farms in the poor-land livestock rearing group, only those with a production of £2,500 covered their overheads and production costs. A minimum output of £2,000 for each type of holding was required to bring in an income equal to that of a farm worker, and £2,500 if interest on capital is included. If hill sheep are the sole product, this would require a flock size of 500 ewes—which supports the conclusion of the Welsh Land Sub-Commission. For a farm in the rather better group, the average upland rearing farm, this would need about 10 cows and followers, with 200 ewes.

Amalgamation and the consequent reduction in the number of the smaller holdings should not be the only target because the application of modern technical methods could help many to achieve the necessary minimum production. The authors emphasize the great variation in management abilities, and discuss the influence of such factors as the high proportion of older men on the difficulties of improvement by more technical education, and advice. The possible methods of improvement are discussed, and examples of the two main types are given. The systematic betterment of the soil, where possible, is the "traditional improvement" pattern, and for this the Livestock Rearing Acts cater admirably. A less orthodox type of improvement is shown in an upland farm of 200 acres, between 600 and 1,100 feet, which permitted of self-fed silage for beef cattle; this is quoted from Hallett's study of grass fattening on Welsh farms. In addition to the necessary tillage and sward improvements, it called for expenditure on a building for 120-150 cattle.

Among other possible ways of increasing the farm income, pigs, poultry, and seed potatoes are discussed, and also the reluctance of the hill farmer to include these enterprises.

Space will not allow all the important results to be even briefly discussed, but mention should be made of the author's

concern lest, in an effort to reconcile long-term reorganization and development with the need to prop up the existing system in the short run, there should be a tendency to perpetuate the causes of the present state of poverty in hill farming. The courageous suggestion is made that farmers on the small holdings should be helped by an income type of subsidy during their lifetime, after which their farms would be taken over for amalgamation.

E.J.R.

Trace Elements in Plants. (3rd Edition). WALTER STILES. Cambridge University Press. 40*s*.

A very valuable book for anyone experimenting with plants or advising growers, as well as for the specialist in crop nutrition. The author deals with both the physiological and pathological aspects of the subject but not primarily with field control measures for the diseases caused by trace element deficiency or excess.

Although nominally a third edition this is virtually a new book, giving an up-to-date record of our knowledge of the functions of trace elements in plants and what happens when they are deficient or in excess, how their absorption by the plant is influenced by soil and growth conditions, and methods for studying micro-nutrient problems.

It is fascinating to read in clear, concise English of the careful experimental work which has shown that plants need minute amounts of these elements for survival. The description of the way in which various environmental factors influence the supply and uptake of trace elements elucidates problems which have doubtless puzzled most people looking at field crops at one time or another. The chapter on the functions of trace elements and their role in the enzyme systems of plants, while being more difficult, is no less absorbing. A short chapter deals with diseases of animals arising from the lack or excess of trace elements in the herbage they graze.

The book contains 200 pages of text in clear, easily read print, 30 pages of references to original works, 20 pages of index and 16 monochrome illustrations of diseased plants. The value of these plates is questionable. Plate IC is not typical of manganese deficiency of sugar beet in the field and should be changed.

R.H.

Farm Crop Irrigation: The Economic Aspects. (Report No. 55). J. S. NIX and C. N. PRICKETT. School of Agriculture, Cambridge. 4*s*.

Even the most competent farmers are at a loss on occasions to grasp the full significance and implications of new methods of production. Although crop irrigation is no new technique (its history stretches back over hundreds of years), an authoritative analysis showing its relevance to modern farming practice has long been needed. For this reason alone the present report should be welcomed. The authors, a university agricultural economist and a technical officer on the staff of the Ministry of Agriculture, Fisheries and Food, are also to be congratulated on having produced a thorough, readable, and nicely balanced review of the techniques and economics of irrigation.

Although a broad technical field is covered, it is handled with conciseness. The topics discussed include such matters as systems of irrigation, the water requirements of crops, "organic" irrigation and reservoir construction. Much useful reference material is presented and, in particular, valuable experimental data have been assembled showing the response to irrigation of a variety of farm crops, such as early potatoes, cereals and grass.

The economic analysis gives useful guidance to the capital costs of providing water supplies and equipment, to the levels of running costs and to the likely financial returns. An informative, though brief, section deals with the influence of irrigation on the farm economy as a whole.

It is unfortunate that profitability has been measured with reference to the "total costs" of irrigation, since this could mislead many who have already installed irrigation equipment. In fact, it will pay farmers to irrigate whenever the value of the extra crop produced, less any additional harvesting costs, is likely to exceed the *running* costs of the plant. Once a plant has been installed, depreciation and interest charges become fixed costs and have to be met whether it is used or not. Thus any surplus of income over running costs increases the farm profit or reduces the loss.

It is clear that on economic grounds more widespread farm crop irrigation would be justifiable, given adequate water supplies. But the growing shortage of water throughout the country will undoubtedly limit the adoption of the technique to a comparatively small number of favoured farms.

J.D.S.

Land, Water and Food. (2nd Edition). H. ADDISON. Chapman and Hall. 21*s*.

The supply of life-giving water has been one of the greatest sources of strife throughout the history of the world; wars have been waged because of it, civilizations have crumbled through lack of it and many great nations owe their existence to it.

The author deals primarily with water for agricultural purposes under all its aspects, but he repeatedly returns to his main theme —the skill and enterprise of the engineer in devising schemes which give such material benefits. This aspect is likely to interest and impress particularly readers in the U.K. A whole chapter is devoted to the Fenlands' drainage problems in England.

This country has never had a civil war or even a pitched battle over water; we are apt to regard an adequate supply as a purely technical problem. It is right therefore that we should be reminded of the political and human background to irrigation works.

The book, first published in 1955, does not pretend to be a text-book or even a comprehensive work. Its subject-matter appears to be limited to those areas of which the author has a personal knowledge and it is, as he says, "descriptive rather than speculative". However, his experience is wide and there are not many parts of the world that he has not covered.

There are dangers for the expert who tries to adapt his material for the layman, and it has to be admitted that Mr. Addison has tended to indulge too frequently in asides, which some readers may find distracting. Nevertheless, the book contains a great deal of valuable information, and a lot of it is of absorbing interest.

J.V.S.

Enemies of Game. I.C.I. Game Service Advisory Booklet No. 17.

Gamekeepers and others interested in game preservation normally regard predators as "vermin", and it has been normal practice to kill any feathered or furred predator. Thus it is pleasing to note that the authors of this Advisory Booklet (see also I.C.I. Booklet No. 16, *Winged Vermin Control*) do not like the term "vermin" for the wide variety of animals which may intentionally or accidentally, inflict losses on game birds. Neither do they wish to advocate the indiscriminate destruction of such predators simply because they limit the game crop.

Advice is given on trapping methods, use of the shot gun and other control methods, and the behaviour of the more common mammalian predators is briefly discussed. The need for a *controlled* balance between game and predators is emphasized. The value of predators is always a controversial subject and the study of predator-prey relationships is extremely complicated. Not only game conservation but damage to agricultural crops and the secondary effects on farming livestock must also be considered. Nevertheless this 18-page booklet is a very useful introduction to interested sportsmen or gamekeepers on the control of predators and it can be obtained free from I.C.I. Game Research Station, Burgate Manor, Fordingbridge, Hampshire.

C.J.A.

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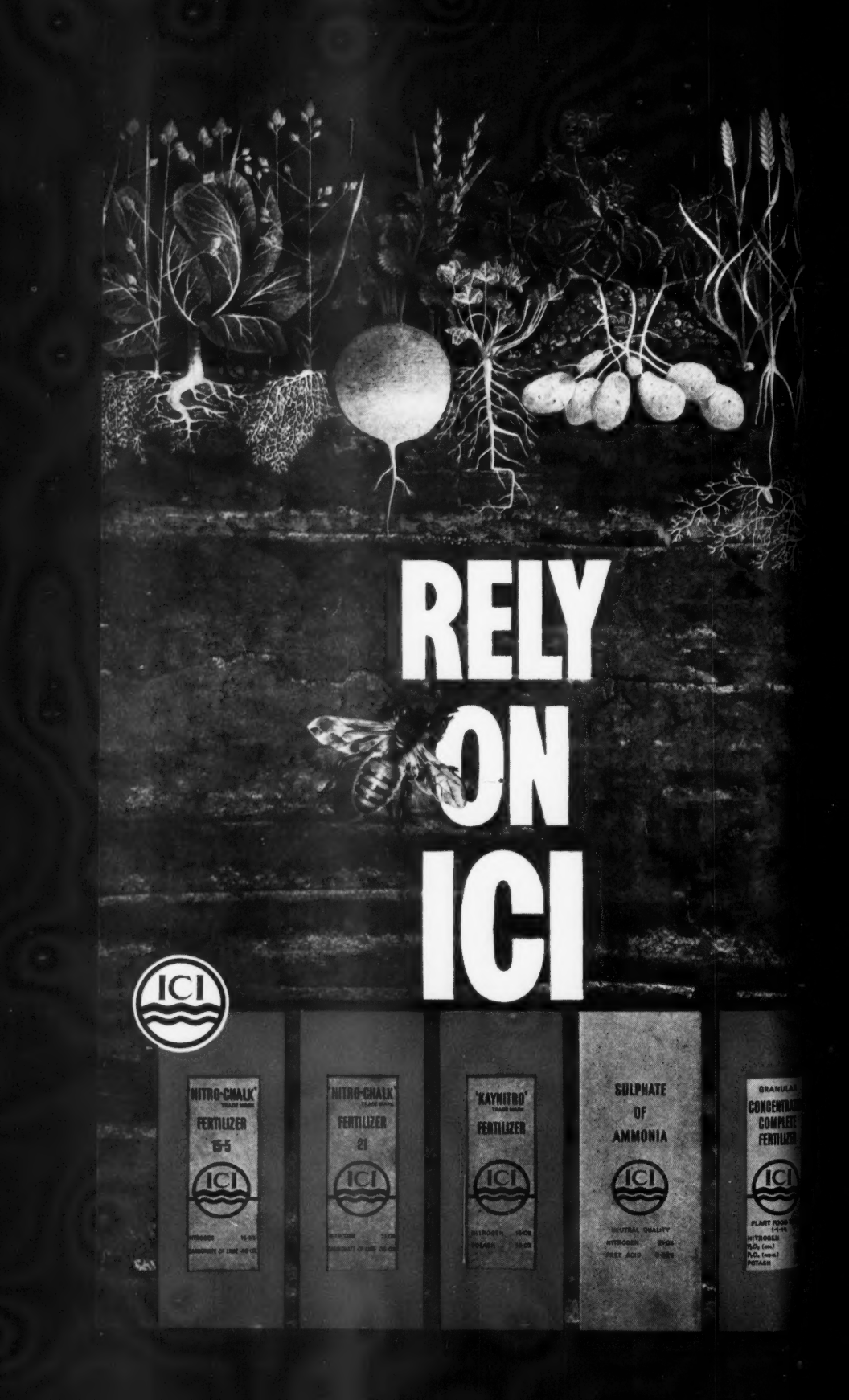
by Hull Printers Limited, Willerby, Hull, Yorks.

(K77) 72-1-61-11.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